

IMAGED AS PART  
OF THE A. R.  
DOC ID # 14177

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**RCRA FACILITY INVESTIGATION  
BETHLEHEM STEEL CORPORATION  
STEELTON, PENNSYLVANIA  
VOLUME 2  
FINAL RFI REPORT  
SEPTEMBER 1991**

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## EXECUTIVE SUMMARY

This RCRA Facility Investigation (RFI) Report has been developed to satisfy the requirements of an Administrative Consent Order pursuant to Section 3013 of RCRA, 42 U.S.C. Section 6934, U.S. Docket Number RCRA-III-011-AM issued by the United States Environmental Protection Agency, Region III (EPA) to Bethlehem Steel Corporation (BSC) on February 27, 1989, to define the identity, presence, magnitude, extent, direction, and rate of movement of any hazardous wastes or hazardous waste constituents which are present or have been released from the BSC, Steelton, Pennsylvania facility. EPA approved the RFI workplan on November 19, 1989 which defined three parts to the investigation; a Historical Investigation, a Field Investigation, and a Groundwater Investigation.

The Historical Investigation was begun in December of 1989. The focus of the Historical Investigation was to assess the degree to which the SWMUs identified on the site provided complete containment of Potential Contaminants of Concern (PCOCs) managed within the SWMUs. Further, the Historical Investigation was intended to identify additional PCOCs and pathways by which PCOCs might be released from the SWMUs. The Historical Investigation Report was submitted in March of 1990 with recommendations to modify the RFI Workplan based on the findings of that report. Those modifications, and modifications to the Quality Assurance Project Plan (QAPP) were approved by the EPA in May of 1990. Based on those modifications, the Field Investigation and Groundwater Investigation were implemented.

The purpose of the Field Investigation was to examine the nature of the materials contained within the SWMUs to assess the potential for those materials to pose a human health or environmental risk. Where releases of material were suspected, soil sampling was performed to further define the nature of any potential health or environmental risks. The data generated by these investigations was compared to site specific action levels developed through the use of an EPA screening model. Upon submission of an Interim Field Investigation Report and the results of the action level screening model, the EPA requested that BSC conduct additional investigations to include groundwater modeling using the Summers model for all PCOCs at all SWMUs, and, an assessment of the risk posed by the potential presence of hexavalent chromium on the site. These supplementary investigations were performed in August of 1991.

The purpose of the Groundwater Investigation was to assess the effects of suspected releases of PCOCs from two landfill areas; a residual waste landfill and a hazardous waste landfill located within the residual waste landfill. Groundwater monitoring wells were sampled in three rounds during 1990. The results of the analytical work performed on those samples were compared to National Primary and Secondary Drinking Water Standards (NPDWS and NSDWS) to assess potential risks to human health and the environment. In addition, surface water and sediment samples were obtained from the Laurel Run, a small, shallow stream located in the vicinity of the landfills, to assess the potential impact of groundwater releases from the landfills on the Susquehanna River. During the course of this investigation, the EPA requested that BSC undertake an additional investigation to assess the possible release of PCOCs from the landfill area via airborne transportation. An Interim Groundwater Investigation Report was submitted to the EPA in April of 1991.

This RFI report contains a description of the work performed, the data generated in the course of the investigations, a discussion of the findings of the investigations, and recommendations for further action. The report is organized in 5 volumes as follows:

Volume 1 contains the approved RFI Workplan and documentation pertaining to the various modification to the Workplan.

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Volume 2 contains the results of the Historical Investigation, the Field Investigation, and the Groundwater Investigation, including the supplementary investigations pertaining to them.

Volume 3 contains the results of two modeling programs intended to establish site specific action levels and compare the results of the RFI investigations to those action levels. This volume also contains the results of the supplementary investigation regarding hexavalent chromium.

Volume 4 contains the results of an ecological evaluation of the site requested by EPA in April of 1991, the scope of which was significantly modified at the EPA's request in August of 1991.

Volume 5 contains the modified QAPP for the RFI as approved by the EPA on May 9, 1990.

The Historical Investigation examined the history of operations at the site including but not limited to the processes, materials, and material handling at the site which could potentially result in a release of PCOCs. This involved interviews with knowledgeable plant personnel, review of design drawings, review of historical aerial photographs, and document searches. Also as part of the Historical Investigation air monitoring was performed at various SWMUs to assess the potential release of volatile constituents (Appendix A). No volatile organic release was observed during air monitoring. Of the 27 SWMUs examined five were found to have been constructed and managed in such a manner as to preclude releases of PCOCs and were subsequently deleted from further investigation. At the remaining SWMUs, evidence of the release of PCOCs, of unknown nature and extent, was identified. Thus, the Field Investigation and Groundwater Investigations were commenced.

The Groundwater Investigation revealed evidence of the release of some PCOCs into the groundwater underlying the landfills. A geo-synthetic cap was installed over the hazardous waste landfill (SWMU 18) during the RFI which appears to have had a positive effect on groundwater quality in the area, which could be observed in the analytical data from monitoring wells over time. At EPA's request a supplementary study was conducted to assess the potential airborne transport of EAF dust from the landfill (Appendix H). The study did not indicate a release of EAF dust by these means. Further, risk evaluation, based on comparison of concentrations of PCOCs in the groundwater to NPDWS and NSDWS indicated that the releases identified did not pose a risk to human health or the environment. Thus, a recommendation of no further action was made.

The Field Investigation was conducted in two phases. In the first phase, water and sediment samples taken from SWMUs other than those related to Electric Arc Furnace (EAF) dust production were analyzed. SWMUs related to the production of EAF dust were not sampled because EAF dust is a listed hazardous waste (K061) and thus, were already expected to be included in the second phase of the Field Investigation. The results of these analyses indicated that PCOCs were contained within some SWMUs at levels, which under worst case scenarios, might pose a risk to human health or the environment. Thus, the second, soil investigation, phase of the Field Investigation was implemented. Soil samples were taken at four depths in proximity to the affected SWMUs. Those samples which revealed the presence of PCOCs at levels which might theoretically be hazardous were analyzed by the EP Toxicity method. None were found to be hazardous by virtue of characteristic toxicity. To evaluate the potential risk to human health and the environment, the maximum value for any PCOC identified at each SWMU was compared to two action levels generated through computer modeling, using models approved by the EPA. One SWMU was found to exceed the action levels developed. This is SWMU 24, the Electric Arc Furnace Spray Chamber Drop Legs which failed to meet the criteria for worker exposure to lead. There is no case in which a SWMU poses a threat to groundwater quality based on the Summers model. At the request of EPA a supplementary study was performed to assess potential worker exposure to hexavalent chromium (Volume 3, section 4.0). The study concludes there is no worker exposure to hexavalent chromium.

The Ecological Evaluation has not revealed evidence of observable stress to wetlands or surface water bodies proximate to the site.

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## EXECUTIVE SUMMARY

This RCRA Facility Investigation (RFI) Report has been developed to satisfy the requirements of an Administrative Consent Order pursuant to Section 3013 of RCRA, 42 U.S.C. Section 6934, U.S. Docket Number RCRA-III-011-AM issued by the United States Environmental Protection Agency, Region III (EPA) to Bethlehem Steel Corporation (BSC) on February 27, 1989, to define the identity, presence, magnitude, extent, direction, and rate of movement of any hazardous wastes or hazardous waste constituents which are present or have been released from the BSC, Steelton, Pennsylvania facility. EPA approved the RFI workplan on November 19, 1989 which defined three parts to the investigation; a Historical Investigation, a Field Investigation, and a Groundwater Investigation.

The Historical Investigation was begun in December of 1989. The focus of the Historical Investigation was to assess the degree to which the SWMUs identified on the site provided complete containment of Potential Contaminants of Concern (PCOCs) managed within the SWMUs. Further, the Historical Investigation was intended to identify additional PCOCs and pathways by which PCOCs might be released from the SWMUs. The Historical Investigation Report was submitted in March of 1990 with recommendations to modify the RFI Workplan based on the findings of that report. Those modifications, and modifications to the Quality Assurance Project Plan (QAPP) were approved by the EPA in May of 1990. Based on those modifications, the Field Investigation and Groundwater Investigation were implemented.

The purpose of the Field Investigation was to examine the nature of the materials contained within the SWMUs to assess the potential for those materials to pose a human health or environmental risk. Where releases of material were suspected, soil sampling was performed to further define the nature of any potential health or environmental risks. The data generated by these investigations was compared to site specific action levels developed through the use of an EPA screening model. Upon submission of an Interim Field Investigation Report and the results of the action level screening model, the EPA requested that BSC conduct additional investigations to include groundwater modeling using the Summers model for all PCOCs at all SWMUs, and, an assessment of the risk posed by the potential presence of hexavalent chromium on the site. These supplementary investigations were performed in August of 1991.

The purpose of the Groundwater Investigation was to assess the effects of suspected releases of PCOCs from two landfill areas; a residual waste landfill and a hazardous waste landfill located within the residual waste landfill. Groundwater monitoring wells were sampled in three rounds during 1990. The results of the analytical work performed on those samples were compared to National Primary and Secondary Drinking Water Standards (NPDWS and NSDWS) to assess potential risks to human health and the environment. In addition, surface water and sediment samples were obtained from the Laurel Run, a small, shallow stream located in the vicinity of the landfills, to assess the potential impact of groundwater releases from the landfills on the Susquehanna River. During the course of this investigation, the EPA requested that BSC undertake an additional investigation to assess the possible release of PCOCs from the landfill area via airborne transportation. An Interim Groundwater Investigation Report was submitted to the EPA in April of 1991.

This report contains a description of the work performed, the data generated in the course of the investigations, a discussion of the findings of the investigations, and recommendations for further action. The report is organized in 5 volumes as follows:

Volume 1 contains the approved RFI Workplan and documentation pertaining to the various modification to the Workplan.

Volume 2 contains the results of the Historical Investigation, the Field Investigation, and the Groundwater Investigation, including the supplementary investigations pertaining to them.

Volume 3 contains the results of two modeling programs intended to establish site specific action levels and compare the results of the RFI investigations to those action levels. This volume also contains the results of the supplementary investigation regarding hexavalent chromium.

Volume 4 contains the results of an ecological evaluation of the site requested by EPA in April of 1991, the scope of which was significantly modified at the EPA's request in August of 1991.

Volume 5 contains the modified QAPP for the RFI as approved by the EPA on May 9, 1990.

The Historical Investigation examined the history of operations at the site including but not limited to the processes, materials, and material handling at the site which could potentially result in a release of PCOCs. This involved interviews with knowledgeable plant personnel, review of design drawings, review of historical aerial photographs, and document searches. Also as part of the Historical Investigation air monitoring was performed at various SWMUs to assess the potential release of volatile constituents (Appendix A). No volatile organic release was observed during air monitoring. Of the 27 SWMUs examined five were found to have been constructed and managed in such a manner as to preclude releases of PCOCs and were subsequently deleted from further investigation. At the remaining SWMUs, evidence of the release of PCOCs, of unknown nature and extent, was identified. Thus, the Field Investigation and Groundwater Investigations were commenced.

The Groundwater Investigation revealed evidence of the release of some PCOCs into the groundwater underlying the landfills. A geo-synthetic cap was installed over the hazardous waste landfill (SWMU 18) during the RFI which appears to have had a positive effect on groundwater quality in the area, which could be observed in the analytical data from monitoring wells over time. At EPA request a supplementary study was conducted to assess the potential airborne transport of EAF dust from the landfill (Appendix H). The study did not indicate a release of EAF dust by these means. Further, risk evaluation, based on comparison of concentrations of PCOCs in the groundwater to NPDWS and NSDWS indicated that the releases identified did not pose a risk to human health or the environment. Thus, a recommendation of no further action was made.

The Field Investigation was conducted in two phases. In the first phase, water and sediment samples taken from SWMUs other than those related to Electric Arc Furnace (EAF) dust production were analyzed. SWMUs related to the production of EAF dust were not sampled because EAF dust is a listed hazardous waste (K061) and thus, were already expected to be included in the second phase of the Field Investigation. The results of these analyses indicated that PCOCs were contained within some SWMUs at levels, which under worst case scenarios, might pose a risk to human health or the environment. Thus, the second, soil investigation, phase of the Field Investigation was implemented. Soil samples were taken at four depths in proximity to the affected SWMUs. Those samples which revealed the presence of PCOCs at levels which might theoretically be hazardous were analyzed by the EP Toxicity method. None were found to be hazardous by virtue of characteristic toxicity. To evaluate the potential risk to human health and the environment, the maximum value for any PCOC identified at each SWMU was compared to two action levels generated through computer modeling, using models approved by the EPA. One SWMU was found to exceed the action levels developed. This is SWMU 24, the Electric Arc Furnace Spray Chamber Drop Legs which failed to meet the criteria for worker exposure to lead. There is no case in which a SWMU poses a threat to groundwater quality based on the Summers model. At the request of EPA a supplementary study was performed to assess potential worker exposure to hexavalent chromium (Volume 3, section 4.0). The study concludes there is no worker exposure to hexavalent chromium.

The Ecological Evaluation has not revealed evidence of observable stress to wetlands or surface water bodies proximate to the site.

## 1.0 INTRODUCTION

This RCRA Facilities Investigation (RFI) Report is in response to the requirements of Administrative Order (AO) No. III-011-AM between the United States Environmental Protection Agency (USEPA) and Bethlehem Steel Corporation (BSC). The AO outlines the terms and conditions for this RFI. BSC submitted an RFI Work Plan to the USEPA, Region III which the Agency approved in November 1989. BSC contracted Dames & Moore to conduct the RFI in December 1989.

The RCRA facility assessment report of August 29, 1986 identified 34 Solid Waste Management Units (SWMUs 1-34) at the Steelton Plant of which three units are RCRA-regulated (18-20) and are classified as Hazardous Waste Management (HWM) units. Seven SWMUs were deleted from investigation by the USEPA because they were not found to have contained hazardous constituents. The approved RFI Work Plan required the investigation of 27 of the SWMUs at the Steelton Plant (Table 1-1). A map showing the locations of these units is included here as Figure 1. In accordance with the approved RFI Work Plan, BSC submitted a Historical Investigation Report (HIR) on 18 of the 27 Solid Waste Management Units on March 7, 1990 (Table 1-1). The HIR identified 5 SWMUs (SWMUs 4, 13, 14, 15, and 16) that appear to have historically prevented the release of Potential Constituents of Concern (PCOCs) and were therefore excluded from further investigation.

Based on results from the historical investigation, BSC submitted a proposal to USEPA to modify the RFI Work Plan on March 7, 1990. In addition, BSC submitted a modified Quality Assurance Project Plan (Volume 5) (QAPP) to Region III Central Laboratory on March 7, 1990. The field investigation commenced at that time based on verbal approvals of the RFI Work Plan and QAPP modifications. BSC received written approval for the RFI Work Plan modifications and revisions to the QAPP in a letter from the USEPA (Mr. Robert E. Greaves) dated May 9, 1990.

Where applicable, Dames & Moore compared concentrations of PCOCs in aqueous samples to National Primary Drinking Water Standards to evaluate risk. Dames & Moore developed Site-specific action levels for solids and generated action levels for each SWMU using risk assessment equations provided by Dr. Roy Smith, Toxicologist with the USEPA, Region III and has also employed a leaching potential model (The Summers Model) to evaluate the potential for PLOC's in migrate to groundwater. Dames & Moore used these action levels to identify the SWMUs that require additional investigation. The RFI Report includes these conclusions. Two separate documents submitted with this RFI Report and incorporated herein by reference are: "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." and Ecological Evaluation Report, RCRA Facility Investigation, Bethlehem Steel Corporation, Steelton, Pennsylvania.

TABLE 1-1  
SOLID WASTE MANAGEMENT UNITS IDENTIFIED IN  
THE RFI WORK PLAN

Unit Number	SWMU Description
1-3	Waste Water Settling Basin *
4	Settling Basin Sump *
5-7	Wastewater Treatment Lagoons *
8	Wastewater Polishing Lagoon *
9	Central Waste Oil Storage Tank *
10	Continuous Caster Heavy Scale Pit *
11	Continuous Caster Fine Scale Pit *
12	Pipe Mill Oil Separator
13	Pipe Mill Expander Pit *
14	Small Rolling Mill Scale Pit *
15	Medium Rolling Mill Scale Pit *
16	Large Rolling Mill Scale Pit *
18	HWM1 Landfill
20	HWM3 Pelletizer *
21	Pelletizer Run-off Tank
22	No. 2 Pelletizer *
24	Electric Arc Furnace Spray Chambers Drop Legs
25	Steel Foundry Electric Furnace Baghouse Bin
29	Frog and Switch Grinder Cyclone Holding Room
30	Residual Landfill
31-32	Caustic Waste Rinse Water Tanks
34	Plant Canal *

\* Included in Historical Investigation.

The following notations apply to the data tables in Section 4 and in Section 5 respectively. Notations that are unique to a table are listed at the bottom of the table.

#### NOTATIONS ON TABLES

U	=	Not detected above either the instrument/method quantitation limit or detection limit. As a result of data validation these values are identified as non-detect
UL	=	Samples below instrument detection limits that are biased low
#	=	Duplicate sample.
-	=	Not Detected.
*	=	Water samples collected on 3/27/90 and 4/12/90, respectively.
+	=	Regulatory Levels. Analyses for Arsenic (As), Chromium (Cr), and Lead (Pb), by USEPA Extraction Procedure Toxicity (EP Tox) Methods. These samples chosen for this analysis based upon total metals analysis results and the procedure outlined in Section 3.6 of this report.
B	=	Detected in Blank.
J	=	Estimated Value.
K	=	Value is biased high.
NA	=	Not Analyzed.
BLS	=	Below land surface
MSL	=	Mean Sea Level
TOT	=	Total Metals
DI	=	Dissolved Metals

## 2.0 SITE HISTORY

### 2.1 GENERAL

The Bethlehem Steel Corporation's Steelton Plant is the oldest recorded steel manufacturing facility in the United States. The history of the Plant begins in September 1865 when a group of businessmen, headed by Samuel M. Felton, formed the Pennsylvania Steel Company. The primary product of the Company would be steel rails. Before formation of the Pennsylvania Steel Company, all rails manufactured in the United States were of iron; steel rails were available, but only by import from England. The group realized the vast superiority of steel over iron and the need for a steel rail production facility in this country. Felton and his group believed that the developments by William Kelly in the steel manufacturing process had advanced technology to the point where a steel production facility in the United States was feasible.

The central Pennsylvania region was an ideal location for the facility. Vast supplies of iron ore and coal as well as transportation by river, canal and rail were readily available. The Company purchased the present site in January 1866. Construction of the facilities commenced on May 12, 1866 and the first heat of steel was produced on May 25, 1867. A year later, in May of 1868, the Pennsylvania Steel Company completed the rail mill. Beginning in 1872 the mill produced railroad frogs and switches. The Company added blast furnaces in 1873 and a blooming mill in 1876. Continued growth through the end of the nineteenth century saw the addition of two 5-ton open hearth furnaces in 1875, two 30-ton furnaces in 1883, a 5-ton furnace in 1889, two 15-ton furnaces in 1890, one 7-ton furnace in 1892, six 50-ton furnaces in 1893, and two 40-ton furnaces in 1900. Construction of the Steel Foundry building occurred in 1901, followed by a refurbished Frog and Switch Department in 1903.

Bethlehem Steel Corporation (BSC) purchased the facility in 1916. Subsequently, BSC added more operations, including fabrication shops, a pipe mill, and a bar mill. The fabrication shop was the primary supplier of structural shapes for the Golden Gate Bridge. BSC continued to operate the plant as a fully integrated steel-making and finishing operation until the early 1960s when they ceased coking and ironmaking operations and demolished those facilities. BSC then manufactured steel from scrap metal in open hearth furnaces. Three electric arc furnaces replaced these furnaces in 1968. The facility at present employs about 2,000 personnel, engaged primarily in the manufacture of rails, rail products, blooms, and expanded welded pipe.

The Susquehanna River has topped its banks on many occasions, flooding parts of the plant and the Borough of Steelton. Devastating floods in 1936 and 1972 completely encompassed the operating facilities.

The facility, since 1875, operated a landfill that, until 1961, both the company and the Borough of Steelton used for disposal of solid wastes. BSC staff covered wastes from the Borough with molten slag, which incinerated the wastes. With the end of ironmaking operations in 1961, receipt of sanitary wastes from the Borough of Steelton to the landfill ceased. Around 1956, Heckett Engineering began to recycle the slag. Between 1956 and 1959, the Air Force used the reprocessed slag as fill for the expansion of Olmstead Air Force Base. In 1976 the Pennsylvania Department of Environmental Resources issued a permit for the landfill under PA permit No. 300583. Refer to Appendix D for a review of site compliance history.

### 2.2 PLANT CANAL

The plant canal was originally constructed as part of the Pennsylvania Canal system, portions of which still exist in many areas of Pennsylvania. Construction on the Steelton portion of the canal system began on July 4, 1826. In 1858, the State of Pennsylvania sold the canal system to the Pennsylvania Railroad and its importance as a transportation system waned, disappearing by the end of the century. The uses of the canal in the area were many. Canal boats transported goods and products to and from the Borough of Steelton and the Steel Plant. Local residents used the canal for swimming and fishing in the summer, and ice skating in the winter.

The Steelton Plant is unique in that the canal supplies makeup water for production operations. The canal is nearly 13,000 feet long, extending almost the entire length of the plant. BSC pumps water from the Susquehanna River into the canal on the downriver end of the plant then the water flows to the northwest. The canal acts as a settling basin to remove suspended solids from the river water before its use in the plant. BSC then pumps water from the canal to the various operations from pump stations located on the canal's northern end by the plant Hospital. The canal is now part of the plant's Recirculating Wastewater Treatment System.

Prior to 1977 only the cooling water from the 20" mill scale pit (E) discharged directly to the canal. Settling basin waters from the central boiler (D) also discharged to the canal but only when the No. 4 main yard sewer (U) could not handle the flow (see Figure 2).

After 1977, (in addition to D and E), there were 4 additional discharge points as seen on Figure 3. These additional discharge points included:

- treated water from the Pipemill Oil Separator (X);
- treated water from the Pipemill Settling Basin(T);
- treated water from the Frog and Switch Settling Basin (G);
- and, treated water from the Polishing Lagoon (Y).

In addition, there is a bypass - the 36" Force Main (M) - used only in emergency conditions. Appendix D identifies past releases of oil into the canal.

Currently, the Borough of Steelton discharges stormwater to the canal through 26 outfalls (Figure 3). Under the existing NPDES Permit (PA 0008303) PADER permits Bethlehem Steel to discharge overflow from the canal to the Susquehanna River through outfall 008.

Fish can still be found in the canal, and large fresh water clams have been found in recent canal dredgings. In 1987, upon BSCs proposal to sell canal dredgings as topsoil, an analysis of the dredgings was performed for EP Toxicity, metals, and freon extractables. The analysis of the dredgings found they were not EP toxic, they had a low freon extractables content, and they met land farming requirements for metals content. BSC did not claim that the dredgings were a fertilizer, a soil conditioner, or a plant growth substance. Barring such claims, Mr. John Longenecker, Chief of the Feed, Fertilizer, and Lime Control in the Pennsylvania Department of Agriculture (PADA) advised BSC that PADA did not regulate its use and did not object to its use as topsoil. Mr. Longenecker advised BSC to contact PADER before proceeding with the sale of the dredgings.

### 2.3 WASTEWATER TREATMENT SYSTEM

Review of BSC plot plans, design drawings, and documents (Appendix C) suggest that before 1972 the Steelton Plant discharged all its industrial wastewater into the Susquehanna River. In 1969, the Commonwealth of Pennsylvania directed BSC to eliminate the discharge of all untreated wastewater. BSC appropriated funds under Capital Order 9234 to install settling sumps, equipped with oil removal gear, on five of the seven plant outfalls to the river. The two other outfalls (002 and 006) discharged only noncontact cooling water to the river. BSC completed this construction in early 1972, after which PADER issued an Industrial Waste Permit (2276206) to the BSC Steelton Plant.



Passage of the Federal Water Pollution Control Act of 1972 established more stringent regulations governing the discharge of wastewaters into the nation's waterways, and it became necessary to obtain a National Pollutant Discharge Elimination System (NPDES) permit. PADER issued a permit to BSC on July 11, 1974 based on interim discharge limitations for suspended solids, oil, and grease, and estimated discharge rates. The USEPA required that BSC install the "Best Practicable Control Technology Currently Available" at the plant by July 1, 1977, after which all permit limitations would be enforced.

To meet the July 1, 1977 deadline, the Chief Engineer at the BSC Steelton, Mr. R. V. Mosher, submitted a capital request for \$2,300,000. He intended to use the funds to install facilities to divert the river discharge of all but one of the industrial outfalls (Outfall 002) and to install a recirculating water treatment system for solids and oil removal. Mr. Mosher submitted the capital request on January 5, 1976, and the BSC Executive Committee approved the request on April 23, 1976. By a letter dated December 14, 1977, BSC informed the Commonwealth of Pennsylvania Regional Water Quality Manager that the recirculating wastewater treatment system commenced operation on December 1, 1977. PADER inspected and approved the new wastewater system on January 4, 1978.

The Steelton Plant's wastewater treatment system includes three settling basins (SWMUs 1, 2, and 3), three lagoons (SWMUs 5, 6, and 7), and one polishing lagoon (SWMU 8). After treatment, the treatment system directs the effluent back into the plant canal for recirculation and reuse. Figure 2 shows the pre-1977 outfalls from the plant and Figure 3 shows the distribution of plant water and plant outfalls after completion of the wastewater treatment system.

Dames & Moore examined aerial photographs from 1949, 1956, 1964, 1970, and 1978 to ascertain whether the wastewater treatment facilities existed at these locations before 1977. The photo interpreter could not draw conclusions from the air photo review because of the scale of the available photographs. However, interviews with plant personnel and a review of BSC documents suggest that no other wastewater treatment facilities existed at these locations before 1972. Sketches of the Plant from 1875, 1878, and 1894 show three or more lakes or basins near the center of the plant. The aerial photograph from 1949 appears to show buildings at the location of these "basins". Additional information is not available about these "basins" and their exact nature and location is not known.

### 3.0 HISTORICAL INVESTIGATION

#### 3.1 SWMU NUMBERS 1, 2, AND 3 - WASTEWATER SETTLING BASINS

##### 3.1.1 Unit Description

The Wastewater Settling Basins (SWMUs 1, 2, and 3) located south of the Rolling Mills Complex on the upriver end of the plant provide for the separation of solids, oil, and grease from plant wastewaters and provide treatment of wastewaters from the Rolling Mill Scale Pits (SWMUs 14, 15, and 16). The wastewater enters a concrete lined sump, where it is pumped to a distribution trough on the north end of the basins at a rate of 3,200 gallons per minute. Using gravity, wastewater flows from the trough into the basins. Gate valves provide the control of flow for all three basins. Basin No. 1 (SWMU 1) receives waste rinse water from the Caustic Rinse Water Tanks (SWMUs 31 and 32) and sludge from the Pipe Mill Expander Pit (SWMU 13) about once every three months.

Oil, grease, and solids separate from the water by gravity settling. The water flows under a baffle at the effluent end of each basin where the oil accumulates on the surface of the baffle. Waters then flow from the basins to three Wastewater Treatment Lagoons (SWMUs 5, 6, and 7) for further treatment. Individual disk skimmers collect the oil that accumulates on the surface of the water in each basin, diverting the oil to the Settling Basin Sump (SWMU 4). After a buildup of solids (sludge) in a basin, the closure of the gate valve, and drainage of the basin, the accumulated solids are allowed to stand until dry. Then, a clam-shell bucket loads the dewatered sludge into hopper cars on the adjacent railroad tracks for transport to the on-site residual waste landfill (SWMU 30). Sludge is dredged from the basins at a rate of roughly 1,200 tons per year.

##### 3.1.2 Waste Description

After a review of the BSC Steelton Plant's MSDS database and discussions with knowledgeable plant personnel, products that may potentially enter the waste stream to SWMUs 1, 2, and 3 have been identified. Table 3-1 presents a list of these products and Appendix B contains the MSDSs for the products.

##### 3.1.3 History of SWMU

The general description and history of the wastewater treatment system located in Section 2.3 contains additional information on SWMUs 1, 2, and 3.

The original design drawings do not specify a concrete containment pad adjacent to basin No. 1. Plant personnel indicated that the concrete pad was installed in 1987 to contain spills that may occur during the unloading of wastes.

A review of design drawings, plot plans, and interviews with plant personnel suggests the production processes, which contribute waste to the basins, do not vary from week to week or month to month. Therefore, the waste stream described in Section 3.1.2 remained fundamentally unchanged since use of the basins began.

**TABLE 3-1  
PRODUCTS USED IN PROCESSES THAT DISCHARGE  
WASTEWATER TO SWMUs 1, 2, AND 3**

BENALENE 370 & BENALENE 370 LIGHT  
FISKE'S HTW GEAR LUBRICANT  
FISKE'S 788 OIL  
FRITCH 004  
GULFCROWN E.P. NO. 2 GREASE  
HOUGHTON-SAFE 419-R  
LPS #1 GREASELESS LUBRICANT  
MCLUBE MOS2-108  
METCO 111  
MOLYKOTE 41 GREASE  
NALCO HM-20 HOT MILL OIL  
SHELL ALVANIA GREASE 2  
SUNEP 1070 (220)  
SUNEP 1060 (150)  
SUNEP 1050 (68)  
SUNEP 1150 (460)  
SUNEP 1090 (320)  
SUNVIS 831 WR  
SUNVIS 931 (68)  
SUNVIS 951 (100)  
SUNWAY LUBRICANT 90  
SWRL GREASE  
1659 RANDO OIL HD 68

### 3.1.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following three potential exposure pathways for the release of PCOCs from SWMUs 1, 2, and 3:

- volatilization of volatile organic compounds (VOCs) from water and oil;
- release to soil or groundwater as a result of spills during dredging;
- and the release to soil or groundwater as a result of leaking of the basins.

Dames & Moore, during the historical investigation, identified a fourth potential exposure pathway at SWMU 1. Release to soil or groundwater may occur as a result of spills during loading of wastes into the basin. The following discusses these potential exposure pathways.

Volatilization from water and oil. Measurements obtained during air monitoring for VOCs, conducted on February 20, 1990, found no detectable levels of VOCs in the air around SWMUs 1, 2, and 3 at the time of sampling. Based on this information and our knowledge of the PCOCs present, the volatilization of VOCs from water and oil in the basins should not impact the site environment nor public health (refer to Appendix A).

Release to soil or groundwater as a result of spills during dredging. Dames & Moore conducted an on-site inspection and interviews with plant personnel to assess the potential for release of PCOCs during the dredging of the settling basins. A review of the dredging procedure and the evidence of stained soils observed around the basins suggests that a release of PCOCs may have occurred. Therefore, constituent and soil sampling was necessary to evaluate the extent of the release.

Release to soil or groundwater as a result of leaking of the basins. Dames & Moore conducted a review and an evaluation of design drawings for the basins. This review concluded that the basins were built as concrete containment structures, which provided complete containment from the time they were put into operation. Therefore, the release of PCOCs from the basins into the underlying soil and groundwater does not require further evaluation.

Release to soil or groundwater as a result of spills during loading of wastes into the basin. The historical investigation indicated that secondary containment improvements were installed adjacent to the basin in 1987. The potential exists that the release of PCOCs may have occurred, during the loading of wastes into the basin before 1988. Therefore, soil sampling adjacent to the containment pad was necessary to evaluate the potential release.

## 3.2 SWMU NUMBER 4 - SETTLING BASIN SUMP

### 3.2.1 Unit Description

The Settling Basin Sump (SWMU 4) is located south of the Rolling Mills Complex on the upriver end of the plant, adjacent to the Wastewater Settling Basins. The sump receives the oil skimmed from the Wastewater Settling Basins (SWMU 1, 2, and 3), the Wastewater Treatment Lagoons (SWMUs 5, 6, and 7), the Wastewater Polishing Lagoon (SWMU 8), and the Continuous Caster Heavy and Fine Scale Pits (SWMUs 10 and 11). Also, SWMU 4 receives waste oil from the Pipe Mill Oil Separator (SWMU 12) and other waste oil generated at the plant. The sump receives oil piped directly from SWMUs 1, 2, and 3. The sump receives other waste oils from drums, dumpsters and vacuum trucks. A permanent pump and piping system pump the oils from the sump into the 8,000-gallon waste-oil storage tank (SWMU 9).

Contrary to the unit description in the RFI Work Plan, review of design drawings shows that the sump is approximately 7 feet by 7 feet by 2.5 feet deep, and is constructed with 2.5-inch welded steel. This change does not require a modification to the RFI Work Plan.

### 3.2.2 Waste Description

After a review of the BSC Steelton Plant's MSDS database and discussions with knowledgeable plant personnel, products that may potentially enter the waste stream to SWMU 4 have been identified. Table 3-2 presents a list of these products and Appendix B contains the MSDSs for the products.

### 3.2.3 History of SWMU

Review of design drawings suggests that SWMU 4 was designed in 1971 with the waste-oil storage tank. According to plant personnel, the paved concrete area now surrounding the sump, as described in the RFI Work Plan, was installed in 1987. This apparently replaced the smaller, 12-inch thick concrete dumpster pad specified in the design drawings.

Before constructing SWMU 4 in 1971, the plant collected and sold most of the waste oil to an oil recycler, using a small quantity for dust control on plant roads. Before the installation of the settling sumps on the outfalls to the Susquehanna River in 1972, the plant discharged oily wastewater directly to the river, as indicated in Section 2.3.

### 3.2.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following three potential exposure pathways for the release of PCOCs from SWMU 4:

- volatilization of volatile organic compounds (VOCs) from water and oil;
- release to soil or groundwater as a result of spills during loading of oil into this sump;
- and the release to soil or groundwater as a result of leaking of the sump.

The following discusses these potential exposure pathways.

Volatilization from oil. Measurements obtained during air monitoring for VOCs, conducted on February 20, 1990, found no detectable levels of VOCs in the air around SWMU 4 at the time of sampling. Based on this information and our knowledge of the PCOCs present, the volatilization of VOCs from oil in the sump should not impact the site environment nor public health (refer to Appendix A).

Release to soil or groundwater as a result of spills during loading of oil into the sump. The RFI Work Plan stated there was no significant potential for release of PCOCs as a result of spills during the loading of oils into the sump. However, the historical investigation revealed that the area around the sump was not paved until 1987. As a result, the possibility exists that a release of PCOCs occurred during the unloading of oil into the sump from dumpsters and drums before 1987. Therefore, soil sampling adjacent to and downgradient from the sump was necessary to evaluate the extent of the potential release.

Release to soil or groundwater as a result of leaking of the sump. Dames & Moore conducted a review of design drawings and an on-site visual inspection of the sumps. The drawings and inspection indicated that the sump was built as a steel containment structure, which provided complete containment from the time it was put into

**TABLE 3-2  
PRODUCTS USED AT THE PLANT  
THAT MAY ENTER SWMU 4**

BENALENE 370 & BENALENE 370 LIGHT  
FISKE'S 788 OIL  
FISKE'S HTW GEAR LUBRICANT  
FISKE'S 788 OIL  
FRITCH 004  
GULFCROWN E.P. NO.2 GREASE  
HOUGHTO-GRIND 50  
HOUGHTO-GRIND 60  
HOUGHTO-SAFE 419-R  
HYDROLUBRIC  
LPS #1 GREASELESS LUBRICANT  
MCLUBE MOS2-108  
METCO 111  
MOLYKOTE 41 GREASE  
NALCO HM-20 HOT MILL OIL  
PLEXALENE 725W ALL GRADES  
ROTARY NOZZLE LUBE  
SHELL ALVANIA GREASE 2  
SUN WAY LUBRICANT 1180  
SUN WAY LUBRICANT 1190  
SUN WAY LUBRICANT 90  
SUNEP 1150 (460)  
SUNEP 1090 (320)  
SUNEP 1030 (68)  
SUNEP 1070 (220)  
SUNEP 1060 (150)  
SUNICUT 444  
SUNVIS 831 WR 1681  
SUNVIS 831 WR  
SUNVIS 916 (32)  
SUNVIS 951 (100)  
SUNVIS 999 (220)  
SUNVIS 931 (68)  
SWRL GREASE  
1659 RANDO OIL HD 68  
02109 URSA SUPER PLUS SAE 15W-40

operation. Therefore, the release of PCOCs from the sumps into the underlying soil and groundwater does not require further evaluation.

### 3.3 SWMU NUMBERS 5, 6, AND 7 - WASTEWATER TREATMENT LAGOONS

#### 3.3.1 Unit Description

The Wastewater Settling Lagoons (SWMUs 5, 6, and 7), located south of the Plant Hospital on the upriver end of the plant, provide for the separation of solids, oil, and grease from plant wastewaters. The Wastewater Settling Basins (SWMUs 1, 2, and 3), the Continuous Caster Heavy and Fine Scale Pits (SWMUs 10 and 11), the 20-inch Mill, and the Boiler Plant supply the wastewaters treated in the lagoons. The lagoons collect the wastewaters pumped from Pump House No. 4. Gate valves provide control of flow to all three lagoons.

Oil, grease, and solids are separated from the water by gravity settling. The water flows under a baffle at the center of each lagoon where the oils accumulate on the surface of the baffle. Waters then flow from the lagoons to the Wastewater Polishing Lagoon (SWMU 8) for further treatment. Individual rope skimmers remove the oil that accumulates on the surface of the water in each lagoon, diverting the oil to individual holding tanks. From the holding tanks, the waste oil is then pumped into individual dumpsters located directly behind the retaining wall that runs parallel to the three lagoons. Individual sloped and bermed concrete pads contain any spill or overflow from the holding tanks. The design of these concrete pads allows excess material to return to the lagoons. Bermed concrete pads directly under the dumpster pans contain spills or overflows from the dumpsters. The Settling Basin Sump (SWMU 4) receives oil that collects in the dumpster pans. After a buildup of solids (sludge) in a lagoon, the closure of the gate valve, and drainage of the lagoon, the accumulated solids are allowed to stand until dry. A small front-end loader enters the lagoon, by way of an access ramp, and pushes the dewatered sludge into a pile at one end. A Gradall loads the dewatered sludge into dump trucks for disposal in the on-site Residual Waste Landfill (SWMU 30).

Contrary to the unit description in the RFI Work Plan, 250 feet by 75 feet by 10 feet deep, with a capacity of 880,000 gallons are the dimensions of each basin posted at the unit and confirmed by review of engineering drawings. This change does not require a modification to the RFI Work Plan.

#### 3.3.2 Waste Description

After a review of the BSC Steelton Plant's MSDS database and discussions with knowledgeable plant personnel, products that may potentially enter the waste stream to SWMUs 5, 6, and 7 have been identified. Table 3-3 presents a list of these products and Appendix B contains the MSDSs for the products.

#### 3.3.3 History of SWMU

The general description and history of the wastewater treatment system located in Section 2.3 contains additional information on SWMUs 5, 6, and 7.

The original design drawings do not specify secondary containment for the oil skimming system. Plant personnel have indicated that the secondary concrete containment was installed in 1987 or 1988.

A review of design drawings, plot plans, and interviews with plant personnel suggests the production processes, which contribute waste to the basins, do not vary from week to week or month to month. Therefore, the waste stream described in Section 3.3.2 remained fundamentally unchanged since use of the basins began.

### 3.3.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following three potential exposure pathways for the release of PCOCs from SWMUs 5, 6, and 7:

- volatilization of volatile organic compounds (VOCs) from water and oil;
- release to soil or groundwater as a result of spills during dredging;
- and the release to soil or groundwater as a result of leaking of the lagoons.

Dames & Moore, during the historical investigation, identified a fourth potential exposure pathway at SWMUs 5, 6, and 7. Release to soil or groundwater may occur as a result of spills during loading of oil into the holding tanks. The following discusses these potential exposure pathways.

Volatilization from water and oil. Measurements obtained during air monitoring for VOCs, conducted on February 20, 1990, found no detectable levels of VOCs in the air around SWMUs 5, 6, and 7 at the time of sampling. Based on this information and our knowledge of the PCOCs present, the volatilization of VOCs from water and oil in the lagoons should not impact the site environment nor public health (refer to Appendix A).

Release to soil or groundwater as a result of spills during dredging. Dames & Moore conducted an on-site inspection and interviews with plant personnel assess the potential for release of PCOCs during the dredging of the lagoons. A review of the dredging procedure and the evidence of stained soils observed around the lagoons suggests that a release of PCOCs may have occurred. Therefore, constituent and soil sampling was necessary to evaluate the extent of the release.

Release to soil or groundwater as a result of leaking of the lagoons. Dames & Moore conducted a review and an evaluation of design drawings for the lagoons. This review concluded that the lagoons were built as concrete containment structures, which provided complete containment from the time they were put into operation. Therefore, the release of PCOCs from the lagoons into the underlying soil and groundwater does not require further evaluation.

Release to soil or groundwater as a result of spills during loading of oil into the holding tanks. The historical investigation indicated that secondary containment improvements were installed around the oil holding tanks in 1987 or 1988. The potential exists that the release of PCOCs may have occurred, during the loading of oil into the holding tanks before 1988. Therefore, soil sampling adjacent to the tanks was necessary to evaluate the potential release.

## 3.4 SWMU NUMBER 8 - WASTEWATER POLISHING LAGOON

### 3.4.1 Unit Description

The Wastewater Polishing Lagoon (SWMU 8) located east of the Wastewater Treatment Lagoons (SWMUs 5, 6, and 7) on the upriver end of the plant provides additional separation of solids, oil, and grease from the water

**TABLE 3-3  
PRODUCTS USED IN PROCESSES  
THAT DISCHARGES  
WASTEWATER TO  
SWMUS 5, 6, AND 7**

BENALENE 370 & BENALENE 370 LIGHT  
FISKE'S HTW GEAR LUBRICANT  
FISKE'S 788 OIL  
FRITCH 004  
GULFCROWN E.P. NO. 2 GREASE  
HOUGHTON-SAFE 419-R  
LPS #1 GREASELESS LUBRICANT  
MCLUBE M052-108  
METCO 111  
MOLYKOTE 41 GREASE  
NALCO HM-20 HOT MILL OIL  
PLEXALENE 725W ALL GRADES  
ROTARY NOZZLE LUBE  
SHELL ALVANIA GREASE 2  
SUNEP 1070 (220)  
SUNEP 1060 (150)  
SUNEP 1030 (68)  
SUNEP 1150 (460)  
SUNEP 1090 (320)  
SUNVIS 431 WR  
SUNVIS 931 (68)  
SUNVIS 951 (100)  
SUNWAY LUBRICANT 90  
SWRL GREASE  
1659 RANDO OIL HD 68

after it leaves the wastewater treatment lagoons. The wastewater flows from the Wastewater Polishing Lagoon into the plant canal discharging through Outfall 102.

Oil, grease, and solids are separated from the water by gravity settling. The water flows under a baffle at the effluent end of the lagoon where the oil accumulates on the surface of the baffle. A rope skimmer collects the oil that accumulates on the surface of the water in the lagoon, diverting it to a dumpster for transport to SWMU 4. A bermed concrete pad contains spills from the dumpster, returning any spill to the lagoon. A float and suction pump removes settled solids and deposits them in wastewater treatment lagoon No. 6. Removal of solids from the bottom of the polishing lagoon has occurred only once since the lagoon became operational.

Contrary to the unit description in the RFI Work Plan, the posted dimensions of the polishing lagoon are 400 feet by 25 feet by 5 feet deep, with a capacity of 400,000 gallons confirmed by review of engineering drawings. This change does not require a modification of the RFI Work Plan.

#### 3.4.2 Waste Description

Section 3.3.2 identifies the waste products that may potentially enter the waste stream to SWMU 8, which is identical to that of SWMUs 5,6 and 7.

#### 3.4.3 History of SWMU

The general description and history of the wastewater treatment system located in Section 2.3 contains additional information on SWMU 8.

The original design drawings do not specify secondary containment for the oil skimming system. Plant personnel have indicated that the secondary concrete containment was added in 1987 or 1988.

Section 3.3.2 identifies the production processes that contribute wastes to the Wastewater Polishing Lagoon.

#### 3.4.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following two potential exposure pathways for the release of PCOCs from SWMU 8:

- volatilization of volatile organic compounds (VOCs) from water and oil;
- and the release to soil or groundwater as a result of leaking of the lagoon.

Dames & Moore, during the historical investigation, identified a third potential exposure pathway at SWMU 8. Release to soil or groundwater may occur as a result of spills during loading of oil into dumpsters. The following discusses these potential exposure pathways.

Volatilization from water and oil. Measurements obtained during air monitoring for VOCs, conducted on February 20, 1990, found no detectable levels of VOCs in the air around SWMU 8 at the time of sampling. Based on this information and our knowledge of the PCOCs present, the volatilization of VOCs from water and oil in the lagoon should not impact the site environment nor public health (refer to Appendix A).

Release to soil or groundwater as a result of leaking of the lagoon. Dames & Moore conducted a review and an evaluation of design drawings for the lagoon. This review concluded that the lagoon was built as a concrete containment structure, which provided complete containment from the time it was put into operation. Therefore, the release of PCOCs from the lagoon into the underlying soil and groundwater does not require further evaluation.



Release to soil or groundwater as a result of spills during loading of oil into the holding tanks. The historical investigation indicated that secondary containment improvements were installed around the oil dumpster pad in 1987 or 1988. The potential exists that the release of PCOCs may have occurred, during the loading of oil into the oil dumpsters before 1988. Therefore, soil sampling adjacent to the oil dumpster pad was necessary to evaluate the potential release.

### 3.5 SWMU NUMBER 9 - CENTRAL WASTE OIL STORAGE TANK

#### 3.5.1 Unit Description

The Central Waste Oil Storage Tank, located south of the Rolling Mill Complex on the upriver end of the plant and adjacent to the Wastewater Settling Basins (SWMU 1, 2, and 3), stores waste oil received from the settling basin sump (SWMU 4). The tank is constructed of welded steel pipe and is approximately 8 feet in diameter and 39 feet high with a wall thickness of 5/8-inch.

#### 3.5.2 Waste Description

Section 3.2.2 identifies the waste oils that may be present in SWMU 9, which are identical to those for SWMU 4.

#### 3.5.3 History of SWMU

Review of design drawings indicates that SWMU 9 was designed in 1971 with SWMU 4. The original design drawings do not specify any form of secondary containment for the tank. Plant personnel have indicated that the existing paved area around the tank was installed in 1987 or 1988 to provide secondary containment.

Plant personnel reported that the tank overflowed in the past with at least one spill occurring after installation of the concrete containment pad.

Section 3.2.3. describes how waste oil was handled before the construction of SWMU 9.

#### 3.5.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following two potential exposure pathways for the release of PCOCs from SWMU 9:

- release to soil or groundwater as a result of spills or overfilling during unloading of oil into tank trucks;
- and the release to soil or groundwater as a result of leaking of the tank.

The following discusses these potential exposure pathways.

Release to soil or groundwater as a result of spills or overfilling during unloading of oil into tank trucks. The historical investigation revealed that the Waste Oil Tank did not have secondary containment before 1987. Although there is no evidence of a spill occurring before the installation of the secondary containment pad, plant personnel reported that the tank overflowed at least once after installation of the pad. Therefore, the possibility exists that a spill occurred before the installation of the secondary containment pad. In addition, the potential exists that a release of PCOCs occur during the unloading of oil from the tank into tank trucks before 1987. Soil sampling adjacent to and downgradient from the containment pad was necessary to evaluate the nature of the potential release.



Potential release to soil or groundwater as a result of leaking of the tank. Dames & Moore conducted a review of design drawings and an on-site visual inspection of the tank. The drawings and inspection indicated that no leaks occurred in the tank from the time it was put into operation. Therefore, the release of PCOCs from the tank into the underlying soil and groundwater does not require further evaluation.

### 3.6 SWMU NUMBERS 10 AND 11 - CONTINUOUS CASTER SCALE PIT

#### 3.6.1 Unit Description

The Continuous Caster Scale Pit, located outside the Caster building on the upriver end of the plant, provides for the separation of iron scale, oil, and grease from the Continuous Caster wastewater. The scale pit, which is divided into two sections, consists of the Heavy Scale Pit (SWMU 10) and the Fine Scale Pit (SWMU 11).

Design drawings show the pit construction consists of reinforced concrete with a 2-foot thick concrete floor and specifies the minimum compression strength of the concrete at 3,000 psi. The total dimensions of the Continuous Caster Scale Pit are approximately 31 feet long by 36 feet wide by 31 feet deep.

Oils, greases, and solids separate from the wastewater by gravity settling. The wastewater flows from the Continuous Caster under a baffle separating the Heavy Scale Pit from the Fine Scale Pit. The oils accumulate on the surface of the Heavy Scale Pit. A skimmer removes this oil and deposits it into a 55-gallon drum. When full, the drum is emptied into a dumpster located adjacent to the scale pit. The Settling Basin Sump (SWMU 4) collects the waste oil from the dumpster. A bermed pad contains overflows or spills from the 55-gallon drums directing them back into the scale pit. The oil dumpster is not on a containment pad. The Wastewater Treatment Lagoons (SWMUs 5, 6, and 7) further separate the wastewater outflow from the Fine Scale Pit.

Presently, Heckett Engineering dredges accumulated iron scale from the pits and transports the material, by truck, to the Heckett facilities. Then, Heckett consolidates the iron scales generated at the plant for resale to the plant or off-site users. The loading of the iron scale occurs on a concrete pad that collects drippings or leakage that occur during the loading process, diverting the drippings or leakage back to the scale pit.

#### 3.6.2 Waste Description

After a review of the BSC Steelton Plant's MSDS database and discussions with knowledgeable plant personnel, products that may potentially enter the waste stream to SWMUs 10, and 11 have been identified. Table 3-4 presents a list of these products and Appendix B contains the MSDSs for the products.

TABLE 3-4 PRODUCTS USED IN THE CONTINUOUS CASTER THAT MAY ENTER SWMUS 10 & 11
HOUGHTON-SAFE 419-R ROTARY NOZZLE LUBE PLEXALENE 725W ALL GRADES SUN WAY 1190 831 WR

#### 3.6.3 History of SWMU

Review of design drawings, plot plans, and interviews with plant personnel show that construction of SWMUs 10 and 11 occurred with the construction of the Continuous Caster in 1982. Section 3.6.1 describes the waste handling procedures since the SWMUs became operational.

### 3.6.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following three potential exposure pathways for the release of PCOCs from SWMUs 10 and 11:

- volatilization of volatile organic compounds (VOCs) from water and oil in the scale pit;
- release to soil or groundwater as a result of spills during the removal of oil from the scale pit;
- and the release to soil or groundwater as a result of leaking of the scale pit.

The following discusses these potential exposure pathways.

Volatilization from water and oil. Measurements obtained during air monitoring for VOCs, conducted on February 20, 1990, found no detectable levels of VOCs in the air around SWMUs 10 and 11 at the time of sampling. Based on this information and our knowledge of the PCOCs present, the volatilization of VOCs from water and oil in the scale pit should not impact the site environment nor public health (refer to Appendix A).

Release to soil or groundwater as a result of spills during the removal of oil from the scale pit. The RFI Work Plan stated there was no significant potential for release of oils into the environment. The historical investigation revealed that although the 55-gallon drum that collects the oil from the skimmer sits on a containment pad, the dumpster where the drum is emptied does not sit on a containment pad. Because of this design, the potential exists that the release of PCOCs occurred during the unloading of oil from the 55-gallon drum into the dumpster. Therefore, soil sampling adjacent to the dumpster was necessary to evaluate the nature of the potential release.

Release to soil or groundwater as a result of leaking of the scale pit. Dames & Moore conducted a review and an evaluation of design drawings for the scale pit. This review concluded that the scale pit was built as concrete containment structures, which provided complete containment from the time it was put into operation. Therefore, the release of PCOCs from the scale pit into the underlying soil and groundwater does not require further evaluation.

## 3.7 SWMU NUMBER 13 - PIPE MILL SCALE PIT

### 3.7.1 Unit Description

The Pipe Mill Expander Pit (SWMU 13), located within the Pipe Mill on the downriver end of the plant, separates solids from the expander process water. No discharges of water from the expander pit occur since the expander process recycles water in the pit adding make-up water as needed.

Using a suction truck to remove solid residue is from the pit, the sludge is deposited in No. 1 Wastewater Settling Basin (SWMU 1). The design of the scale pit is such that drippage that occurs while loading the solids into the suction truck is routed back into the scale pit.

### 3.7.2 Waste Description

After a review of the BSC Steelton Plant's MSDS database and discussions with knowledgeable plant personnel, products that may potentially enter the waste stream to SWMU 13 have been identified. Table 3-5 presents a list of these products and Appendix B contains the MSDSs for the products.

### 3.7.3 History of SWMU

Review of design drawings, plot plans, and interviews with plant personnel show that SWMU 13 was constructed with the installation of the Pipe Mill Expander around 1955. Section 3.7.1 describes wastes handling

procedures since 1977. Before the installation of the wastewater treatment system in 1977, the sludge transported directly to the Residual Waste Landfill (SWMU 30) for disposal.

### 3.7.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following two potential exposure pathways for the release of PCOCs from SWMU 13:

- volatilization of volatile organic compounds (VOCs) from water and oil;
- and the release to soil or groundwater as a result of leaking of the expander pit.

The following discusses these potential exposure pathways.

Volatilization from water and oil. Measurements for SWMU 13 were not obtained during air monitoring for VOCs, conducted on February 20, 1990. However, based on sampling information of other scale pits, the same oils used at other scale pits and our knowledge of the PCOCs present at the expander pit, the volatilization of VOCs from water and oil in the expander pit should not impact the site environment nor public health (refer to Appendix A).

Release to soil or groundwater as a result of leaking of the basins. Dames & Moore conducted a review and an evaluation of design drawings for the expander pit. This review concluded that the expander pit was built as concrete containment structure, which provided complete containment from the time it was put into operation. Therefore, the release of PCOCs from the expander pit into the underlying soil and groundwater does not require further evaluation.

## 3.8 SWMU NUMBER 14 - SMALL ROLLING MILL SCALE PIT

### 3.8.1 Unit Description

The Small Rolling Mill Scale Pit (SWMU 14), located within the Rolling Mill Complex on the upriver end of the plant, separates iron scale from the 28-inch Rolling Mill contact cooling water. The scale pit was constructed as an integral part of the 28-inch Rolling Mill.

Contrary to the unit description in the RFI Work Plan, design drawings show the pit construction consists of reinforced concrete with a 18 inch thick concrete floor. The total dimensions of the scale pit are 6 feet wide by 8 feet long by 20 feet deep.

Presently, Heckett Engineering dredges accumulated iron scale from the pits and transports the material, by hopper car, to the Heckett facilities. Then, Heckett consolidates the iron scales generated at the plant for resale to the plant or off-site users. Wastewater from the hopper car loading area, which is paved to contain drainage from the car, and the scale pit, discharges to the Wastewater Settling Basins (SWMU 1, 2, and 3) for treatment.

### 3.8.2 Waste Description

After a review of the BSC Steelton Plant's MSDS database and discussions with knowledgeable plant personnel, products that may potentially enter the waste stream to SWMU 14 have been identified. Table 3-6 presents a list of these products and Appendix B contains the MSDSs for the products.

**TABLE 3-5  
PRODUCTS USED IN THE PIPE  
MILL THAT MAY ENTER SWMU 13**

LPS #1 GREASELESS LUBRICANT  
MCLUBE MOS2-108  
METCO 111  
NALCO HM-20 HOT MILL OIL  
SUN WAY LUBRICANT 90  
1659 RANDO OIL HD 68

Section 3.8.1 describes the iron scale handling procedures used since 1956. Before 1956, iron scale was transported to the Residual Waste Landfill (SWMU 30) for disposal. Before December 1977, wastewater was discharged to the Susquehanna River through outfall 001. Section 2.3 provides a more detailed description of the wastewater treatment system.

### 3.8.3 History of SWMU

The 1986 RFI Assessment report by Earth Technology Corporation suggests that the 28-inch Rolling Mill started production in 1945. However, a review of the original design drawings shows that 28-inch mill started operations around 1914.

### 3.8.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following two potential exposure pathways for the release of PCOCs from SWMU 14:

- volatilization of volatile organic compounds (VOCs) from water and oil in the scale pit;
- and the release to soil or groundwater as a result of leaking of the the scale pit.

The following discusses these potential exposure pathways.

Volatilization from water and oil. Measurements obtained during air monitoring for VOCs, conducted on February 20, 1990, found no detectable levels of VOCs in the air around SWMUs 14 at the time of sampling. Based on this information and our knowledge of the PCOCs present, the volatilization of VOCs from water and oil in the scale pit should not impact the site environment nor public health (refer to Appendix A).

Release to soil or groundwater as a result of leaking of the scale pit. Dames & Moore conducted a review and an evaluation of design drawings for the scale pit. This review concluded that the scale pit was built as concrete containment structure, which provided complete containment from the time it was put into operation. Therefore, the release of PCOCs from the scale pit into the underlying soil and groundwater does not require further evaluation.

## 3.9 SWMU NUMBER 15 - MEDIUM ROLLING MILL SCALE PIT

### 3.9.1 Unit Description

The Medium Rolling Mill Scale Pit (SWMU 15), located within the Rolling Mill Complex on the upriver end of the plant, separates iron scale from the 35-inch Rolling Mill quench water. The scale pit was constructed as an integral part of the 35-inch Rolling Mill.

Contrary to the unit description in the RFI Work Plan, design drawings show the pit construct consists of reinforced concrete with a 18 inch thick concrete floor. The total dimensions of the scale pit are 6 feet wide by 8 feet long by 20 feet deep.

Presently, Heckett Engineering dredges accumulated iron scale from the pits and transports the material, by hopper car, to the Heckett facilities. Then, Heckett consolidates the iron scales generated at the plant for resale

**TABLE 3-6  
PRODUCTS USED IN THE 28-INCH  
ROLLING MILL THAT MAY ENTER  
SWMU 14**

BENALENE 370 & BENALENE 370 LIGHT  
FISKE'S 788 OIL  
HOUGHTO-SAFE 419-R  
NALCO HM-20 HOT MILL OIL  
SUNEP 1050 (68)  
SUNEP 1060 (150)  
SUNEP 1070 (220)  
SUNVIS 951 (100)  
SWRL GREASE  
HOUGHTO-SAFE 419-R  
MOLYKOTE 41 GREASE  
SUNVIS 831 WR

to the plant or off-site users. Wastewater from the hopper car loading area, which is paved to contain drainage from the car, and the scale pit, discharges to the Wastewater Settling Basins (SWMU 1, 2, and 3) for treatment.

### 3.9.2 Waste Description

After a review of the BSC Steelton Plant's MSDS database and discussions with knowledgeable plant personnel, products that may potentially enter the waste stream to SWMU 15 have been identified. Table 3-7 presents a list of these products and Appendix B contains the MSDSs for the products.

Section 3.9.1 describes the iron scale handling procedures used since 1956. Before 1956, iron scale was transported to the Residual Waste Landfill (SWMU 30) for disposal. Before December 1977, wastewater was discharged to the Susquehanna River through outfall 001. Section 2.3. provides a more detailed description of the wastewater treatment system.

### 3.9.3 History of SWMU

The 1986 RFI Assessment report by Earth Technology Corporation suggests that the 35-inch Rolling Mill started production in 1945. However, a review of the original design drawings shows that 35-inch mill started operations around 1926.

### 3.9.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following two potential exposure pathways for the release of PCOCs from SWMU 15:

- volatilization of volatile organic compounds (VOCs) from water and oil in the scale pit;
- and the release to soil or groundwater as a result of leaking of the the scale pit.

The following discusses these potential exposure pathways.

Volatilization from water and oil. Measurements obtained during air monitoring for VOCs, conducted on February 20, 1990, found no detectable levels of VOCs in the air around SWMUs 15 at the time of sampling. Based on this information and our knowledge of the PCOCs present, the volatilization of VOCs from water and oil in the scale pit should not impact the site environment nor public health (refer to Appendix A).

Release to soil or groundwater as a result of leaking of the scale pit. Dames & Moore conducted a review and an evaluation of design drawings for the scale pit. This review concluded that the scale pit was built as concrete containment structure, which provided complete containment from the time it was put into operation. Therefore, the release of PCOCs from the scale pit into the underlying soil and groundwater does not require further evaluation.

## 3.10 SWMU NUMBER 16 - LARGE ROLLING MILL SCALE PIT

### 3.10.1 Unit Description

**TABLE 3-7  
PRODUCTS USED IN THE 35-INCH  
ROLLING MILL THAT MAY ENTER  
SWMU 15**

BENALENE 370 & BENALENE 370 LIGHT  
FISKE'S 788 OIL  
HOUGHTO-SAFE 419-R  
NALCO HM-20 HOT MILL OIL  
SUNEP 1050 (68)  
SUNEP 1060 (150)  
SUNEP 1070 (220)  
SUNVIS 951 (100)  
SWRL GREASE  
HOUGHTO-SAFE 419-R  
MOLYKOTE 41 GREASE  
SUNVIS 831 WR

The Large Rolling Mill Scale Pit (SWMU 16), located within the Rolling Mill Complex on the upriver end of the plant, separates iron scale from the 44-inch Rolling Mill quench water. The scale pit was constructed as an integral part of the 44-inch Rolling Mill.

Contrary to the unit description in the RFI Work Plan, design drawings show the pit construct consists of reinforced concrete with the concrete floor thickness varying from 18 to 24 inches. The total dimensions of the scale pit are 6 feet wide by 8 feet long by 22 feet deep.

Presently, Heckett Engineering dredges accumulated iron scale from the pits and transports the material, by hopper car, to the Heckett facilities. Then, Heckett consolidates the iron scales generated at the plant for resale to the plant or off-site users. Wastewater from the hopper car loading area, which is paved to contain drainage from the car, and the scale pit, discharges to the Wastewater Settling Basins (SWMU 1, 2, and 3) for treatment.

### 3.10.2 Waste Description

After a review of the BSC Steelton Plant's MSDS database and discussions with knowledgeable plant personnel, products that may potentially enter the waste stream to SWMU 16 have been identified. Table 3-8 presents a list of these products and Appendix B contains the MSDSs for the products.

Section 3.10.1 describes the iron scale handling procedures used since 1956. Before 1956, iron scale was transported to the Residual Waste Landfill (SWMU 30) for disposal. Before December 1977, wastewater was discharged to the Susquehanna River through outfall 001. Section 2.3 provides a more detailed description of the wastewater treatment system.

**TABLE 3-8  
PRODUCTS USED IN THE 44-INCH  
ROLLING MILL THAT MAY ENTER  
SWMU 16**

FISKE'S HTW GEAR LUBRICANT  
FISKE'S 788 OIL  
FRITCH 004  
GULFCROWN E.P. NO. 2 GREASE  
HOUGHTON-SAFE 419  
NALCO HM-20 HOT MILL OIL  
SHELL ALVANIA GREASE 2  
SUNEP 1090 (320)  
SUNEP 1150 (460)  
SUNVIS 931 (68)

### 3.10.3 History of SWMU

The 1986 RFI Assessment report by Earth Technology Corporation suggests that the 44-inch Rolling Mill started production in 1945. However, a review of the original design drawings shows that 44-inch mill started operations around 1949.

### 3.10.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following two potential exposure pathways for the release of PCOCs from SWMU 16:

- volatilization of volatile organic compounds (VOCs) from water and oil in the scale pit;
- and the release to soil or groundwater as a result of leaking of the the scale pit.

The following discusses these potential exposure pathways.

Volatilization from water and oil. Measurements obtained during air monitoring for VOCs, conducted on February 20, 1990, found no detectable levels of VOCs in the air around SWMUs 16 at the time of sampling. Based on this information and our knowledge of the PCOCs present, the volatilization of VOCs from water and oil in the scale pit should not impact the site environment nor public health (refer to Appendix A).

Release to soil or groundwater as a result of leaking of the scale pit. Dames & Moore conducted a review and an evaluation of design drawings for the scale pit. This review concluded that the scale pit was built as concrete containment structure, which provided complete containment from the time it was put into operation. Therefore, the release of PCOCs from the scale pit into the underlying soil and groundwater does not require further evaluation.

### 3.11 SWMU NUMBER 20 - HWM3 PELLETIZER

#### 3.11.1 Unit Description

The HWM3 Pelletizer, located near the Electric Shop on the upriver end of the plant, pelletizes the EAF dust for transport. A screw conveyor carries the EAF dust from the No. 1 Baghouse to a holding silo in the Pelletizer building. From the silo, a conveyor feeds the dust into a mixer where the mixer sprays the dust with water. Trucks drive under the pelletizer where the pelletized dust drops through a chute into the trucks. Then, the trucks transported the pelletized EAF dust to an off-site vendor for metals recovery.

#### 3.11.2 Waste Description

The historical investigation concludes that the HWM3 Pelletizer handled only EAF dust since the pelletizer became operational.

#### 3.11.3 History of SWMU

The HWM3 Pelletizer, constructed with the No. 1 Baghouse in 1969, was designed to pelletize EAF dust before its disposal in the HWM1 Landfill (SWMU 18). An 8-inch curb surrounds the asphalt pad located below the Pelletizer. This pad slopes toward the Pelletizer Runoff Tank (SWMU 21) and controls spillage that may occur during the loading of the trucks. The Pelletizer Runoff Tank collects the spillage washed from the containment pad. The 1969 pelletizer design drawings do not specify the containment pad nor the runoff tank. Later design drawings show the addition of the asphalt pad, 8-inch curb, and Pelletizer Runoff Tank (SWMU 21) in 1986. The pad's construction consists of a 1-foot compacted subbase with a coarse asphalt base and an asphalt cover. The Pelletizer Runoff Tank is a 6-inch thick, precast concrete tank 17 feet long by 7 feet wide by 5 feet deep.

#### 3.11.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following two potential exposure pathways for the release of EAF dust from SWMU 20:

- release to soil or groundwater if the loading pad is cracked;
- and release from the loading pad to the surrounding soil by way of vehicular and/or personnel traffic.

The following discusses these potential exposure pathways.

Release to soil or groundwater if the loading pad is cracked. The historical investigation determined that a containment pad did not always exist below SWMU 20. Also, a review of the pelletized dust loading procedures and the quantity of dust observed under the pelletizer suggests a potential exists for a release of EAF dust onto the underlying soil occurred before the installation of the containment pad in 1986. Therefore, soil sampling beneath the asphalt pad was necessary to evaluate the nature of the potential release.

Release from the loading pad to the surrounding soil by way of vehicular and/or personnel traffic. Dames & Moore observed EAF dust around the structure and beyond the containment area during an on-site visual inspection of SWMU 20. Soil samples were collected as outlined in the RFI Work Plan.



### 3.12 SWMU NUMBER 22 - NO. 2 PELLETTIZER

#### 3.12.1 Unit Description

The No. 2 Pelletizer (SWMU 22), located adjacent to the No.2 Baghouse on the upriver end of the plant, pelletizes the EAF dust for transport. A duct system conveys the dust from the No.2 Baghouse to the Pelletizer building. The pelletizer unit sits on a concrete pad, enclosed on three sides by a metal building. Design drawings show the pad construction consists of reinforced concrete with a 1-foot thick concrete floor and specifies the minimum compression strength of the concrete at 3,000 psi. The total dimensions of the concrete floor are approximately 30 feet long by 20 feet wide.

#### 3.12.2 Waste Description

The historical investigation concludes that the No. 2 Pelletizer handled only EAF dust since the pelletizer became operational.

#### 3.12.3 History of SWMU

The No. 2 Pelletizer was designed to pelletize EAF dust before its disposal in the HWM1 Landfill (SWMU 18). 55-gallon drums were loaded with pelletized dust for transport to the HWM1 Landfill (SWMU 18). Emissions were contained by the building during the pelletizing and drum loading procedures. The pelletizing of EAF dust ceased in 1981. Dust is currently loaded from the holding silo into trucks. Emissions are controlled through the use of a dedicated evacuation system.

#### 3.12.4 Discussion of Identified Exposure Pathways

The approved RFI Work Plan identified the following potential exposure pathway for the release of EAF dust from SWMU 22:

- release from surface soil to underlying soil and groundwater.

The following discusses that potential exposure pathway.

Release from surface soil to underlying soil and groundwater. Dames & Moore observed EAF dust around the structure during an on-site visual inspection of SWMU 20. Therefore the potential exists for release of PCOCs from the the EAF dust into the underlying soil and groundwater. Consequently, soil sampling was necessary to evaluate the nature of the potential release.



## 4.0 FIELD INVESTIGATION

### 4.1 METHODS AND PROCEDURES

#### 4.1.1 Decontamination

Dames & Moore's objective is to provide samples of the highest obtainable representativeness for analysis. Equipment used for ground water, surface water, and soil sampling was chosen to minimize interference with chemical analyses and to ensure representative samples. Therefore, all sampling equipment used was constructed of inert materials and was decontaminated in the field prior to use.

Because gloves, tubing, and filters were disposed of after each use, and because the majority of the groundwater samples were collected using dedicated systems for purging, the only groundwater sampling equipment requiring decontamination were the sampling bailers and portable Well Wizard. This equipment was used to purge wells at the HWM-1 Landfill during the first and second sampling rounds. Stainless steel trowels used to collect soil from test pits and sediment samples from Laurel Run were also decontaminated between sampling locations. Bailers and trowels were decontaminated by the following procedure:

- Equipment wash using alquinox soap and tap water
- Tap water rinse and deionized water rinse
- Ten-percent nitric acid rinse (for metals only)
- Distilled/deionized rinse
- Reagent-grade methanol rinse
- Distilled/deionized rinse
- Air dry and wrap in foil

The outside surfaces of the pump and tubing of the portable Well Wizard were decontaminated between wells with a nitric acid rinse followed by a deionized water rinse. The portable Well Wizard was used to purge water from wells at the HWM-1 Landfill during the first and second rounds.

The ponar dredge used for sediment sampling was not rinsed with nitric acid or methanol because of possible degradation of the equipment. It was cleaned with Alquinox and tap water, followed by a deionized water rinse. Samples were obtained from the central portion of the dredge so that the sample had not contacted the sides of the dredge.

#### 4.1.2 General Constituent Sampling Procedures

Constituent samples were collected in accordance with the RFI Work Plan and its subsequently approved modifications at the following SWMUs:

SWMUs 1, 2, and 3	Wastewater Settling Basins
SWMUs 5, 6, and 7	Wastewater Treatment Lagoons
SWMU 9	Central Waste Oil Storage Tank
SWMU 10, 11	Continuous Caster Heavy Scale Pit and Fine Scale Pit
SWMU 12	Pipe Mill Oil Separator
SWMU 13	Pipe Mill Expander Pit

SWMU 14, 15, and 16 . . . . . Rolling Mill Scale Pits  
SWMU 25 . . . . . Steel Foundry Electric Furnace Baghouse Bin  
SWMU 29 . . . . . Frog and Switch Grinder Cyclone Holding Room

All sampling procedures used by Dames & Moore adhered to the guidelines established in the amended and approved QAPP. Sample locations were selected to provide representative samples or, when appropriate, deliberately biased toward the worst case.

New latex gloves were worn at each sampling location. All collected samples were placed in clean sample containers, preserved as required, sealed, labeled, and placed in a cooler maintained at 4°C. Samples were shipped via Federal Express to Wadsworth/Alert Laboratories of North Canton, Ohio, within 24 hours of collection. All sampling equipment was decontaminated between sampling locations pursuant to the procedures described in Section 4.1.1.

#### 4.1.3 SWMU-Specific Constituent Sampling Procedures

##### 4.1.3.1 SWMU 1 - Wastewater Settling Basin

###### 4.1.3.1.1 Wastewater

The wastewater samples from SWMU 1 were composite samples collected by mixing 3 aliquots of wastewater from separate sampling locations. Each wastewater aliquot was collected using a clean glass jar immersed in the water by nylon cord. The aliquots, except those to be analyzed for dissolved metals, were poured directly into a sample bottle containing the proper preservative. Samples to be analyzed for dissolved metals were pumped from the glass jar through a 0.45-micron filter directly into a sampling bottle containing the proper preservative. A peristaltic pump with new tygon tubing attached for each sample was used in the filtering process. Samples for volatile organic compound (VOC) analysis were taken at one location and poured directly from the glass jar into the preserved sampling vials.

The glass jar used for collecting constituent wastewater samples was decontaminated between successive sampling points in accordance with the procedures outlined in Section 4.1.1. New nylon cord was used for each sample.

Although three rounds of constituent wastewater sampling were specified for SWMU 1 in the approved RFI Work Plan, this program was not feasible. As reported in the May 10, 1990, monthly report, an exceptional buildup of solids in SWMU 1 required the SWMU to be emptied and dredged before the third round of sampling could be conducted. Dames & Moore believes the two rounds of analyses adequately represent the wastewater in SWMU 1 because of the similarity of the analytical results from the two rounds.

###### 4.1.3.1.2 Sediment

The sediment sample from SWMU 1 was a composite sample collected by mixing three aliquots of sediment from separate sampling locations. First, a ponar dredge was used to collect sediment from one location at the SWMU. An aliquot was taken from the dredging with a stainless steel trowel and placed in a stainless steel mixing bowl. The process was repeated for the two other sampling locations at the SWMU. The three aliquots were then thoroughly mixed and placed in sample bottles. For VOC analyses, grab samples were taken directly from the ponar dredge at one location in the SWMU and placed in sample bottles.

The stainless steel trowel, ponar dredge, and stainless steel mixing bowl were decontaminated between sampling locations in accordance with the procedures described in Section 4.1.1.

Although three rounds of constituent sediment sampling were specified for SWMU 1 in the approved RFI Work Plan, three rounds were not feasible. As reported in the May 10, 1990, monthly report, an exceptional buildup of solids in SWMU 1 required the SWMU to be emptied and dredged before the second and third rounds of sediment sampling could be conducted. However, Dames & Moore believes the single round of analysis adequately represents the sediment in SWMU 1.

#### 4.1.3.2 SWMUs 2 and 3 - Wastewater Settling Basins

##### 4.1.3.2.1 Wastewater

The wastewater samples from SWMUS 2 and 3 was a composite sample collected by mixing 6 aliquots of wastewater (one aliquot from 3 different sampling locations at each SWMU). Each wastewater aliquot was collected using a clean glass jar immersed into the water by nylon cord. The aliquots, except those to be analyzed for dissolved metals, were poured directly into a sample bottle containing the proper preservative. Samples to be analyzed for dissolved metals were pumped from the glass jar through a 0.45-micron filter directly into a sampling bottle containing the proper preservative. A peristaltic pump with new tygon tubing attached for each sample was used in the filtering process. Samples for VOC analysis were taken at one location and poured directly from the glass jar into the preserved sampling vials.

The glass jar used for collecting constituent wastewater samples was decontaminated between successive sampling points in accordance with the procedures outlined in Section 4.1.1. New nylon cord was used for each sample.

##### 4.1.3.2.2 Sediment

The sediment sample from SWMUs 2 and 3 was a composite sample collected by mixing 6 aliquots of sediment (one aliquot from 3 different sampling locations at each SWMU). A ponar dredge was used to collect sediment from one location at the SWMU. An aliquot was taken from the dredging with a stainless steel trowel and placed in a stainless steel mixing bowl. The process was repeated for the two other sampling locations at the SWMU. The three aliquots were then thoroughly mixed and placed in sample bottles. For VOC analyses, grab samples were taken directly from the ponar dredge at one location in SWMU 2 and placed in sample bottles.

The stainless steel trowel, ponar dredge, and stainless steel mixing bowl were decontaminated between sampling locations in accordance with the procedures described in Section 4.1.1.

#### 4.1.3.3 SWMUs 5, 6, and 7 - Wastewater Treatment Lagoons

##### 4.1.3.3.1 Wastewater

The wastewater samples from SWMUs 5, 6, and 7 was a composite sample collected by mixing 9 aliquots of wastewater from separate sampling locations. Three aliquots were collected at each SWMU. Each aliquot was collected using a clean glass jar immersed into the water by nylon cord. The aliquots, except those to be analyzed for dissolved metals, were poured directly into a sample bottle containing the proper preservative. Samples to be analyzed for dissolved metals were pumped from the glass jar through a 0.45-micron filter directly into a sampling bottle containing the proper preservative. A peristaltic pump with new tygon tubing attached for each sample was used in the filtering process. Samples for VOC analysis were taken at one location and poured directly from the glass jar into the preserved sampling vials.

The glass jar used for collecting constituent wastewater samples was decontaminated between successive sampling points in accordance with the procedures outlined in Section 4.1.1. New nylon cord was used for each sample.

#### 4.1.3.3.2 Sediment

The sediment sample analyzed for SWMUs 5, 6, and 7 was a composite sample collected by mixing 9 aliquots of sediment from separate sampling locations. A ponar dredge was used to collect sediment from one location at the SWMU. An aliquot was taken from the dredging with a stainless steel trowel and placed in a stainless steel mixing bowl. The process was repeated for the two other sampling locations in SWMUs 5, 6, and 7. The nine aliquots were then thoroughly mixed and placed in sample bottles. For VOC analyses, grab samples were taken directly from the ponar dredge and placed in sample bottles.

The stainless steel trowel, ponar dredge, and stainless steel mixing bowl were decontaminated between sampling locations in accordance with the procedures described in Section 4.1.1.

#### 4.1.3.4 SWMU 8 - Wastewater Polishing Lagoon

##### 4.1.3.4.1 Wastewater

The wastewater sample from SWMU 8 is a composite sample collected by mixing 3 aliquots of wastewater from separate sampling locations. Each wastewater aliquot was collected using a clean glass jar immersed into the water by nylon cord. The aliquots, except those to be analyzed for dissolved metals, were poured directly into a sample bottle containing the proper preservative. Samples to be analyzed for dissolved metals were pumped from the glass jar through a 0.45-micron filter directly into a sampling bottle containing the proper preservative. A peristaltic pump with new tygon tubing attached for each sample was used in the filtering process. Samples for VOC analysis were taken at one location and poured directly from the glass jar into the preserved sampling vials.

The glass jar used for collecting constituent wastewater samples was decontaminated between successive sampling points in accordance with the procedures outlined in Section 4.1.1. New nylon cord was used for each sample.

##### 4.1.3.4.2 Sediment

The sediment sample from SWMU 8 was a composite sample collected by mixing 3 aliquots of sediment from separate sampling locations. First a ponar dredge was used to collect sediment from the SWMU. A sample aliquot was taken from the dredging with a stainless steel trowel and placed in a stainless steel mixing bowl. The process was repeated for the two other sampling locations at the SWMU. The three aliquots were then thoroughly mixed and placed in sample bottles. For VOC analyses, grab samples were taken at one location in the SWMU directly from the ponar dredge and placed in sample bottles.

The stainless steel trowel, ponar dredge, and stainless steel mixing bowl were decontaminated between sampling locations in accordance with the procedures described in Section 4.1.1.

#### 4.1.3.5 SWMU 9 - Central Waste Oil Storage Tank SWMU 4 - Settling Basin Sump

As discussed in the modifications to the RFI Work Plan, SWMU 4 and SWMU 9 were investigated as a single unit.

An oil sample was collected from SWMU 9. Aliquots of oil taken via vales located at four levels in the tank of SWMU 9 were composited in a sample bottle.

#### 4.1.3.6 SWMUs 10 and 11 - Continuous Caster Heavy Scale Pit and Fine Scale Pit

##### 4.1.3.6.1 Wastewater

The wastewater sample analyzed from SWMUs 10 and 11 was a composite sample collected by mixing 3 aliquots of wastewater from separate sampling locations. Each wastewater aliquot was collected using a clean glass jar immersed into the water by nylon cord. The aliquots, except those to be analyzed for dissolved metals, were poured directly into a sample bottle containing the proper preservative. Samples to be analyzed for dissolved metals were pumped from the glass jar through a 0.45-micron filter directly into a sampling bottle containing the proper preservative. A peristaltic pump with new tygon tubing attached for each sample was used in the filtering process. Samples for VOC analysis were taken at one location and poured directly from the glass jar into the preserved sampling vials.

The glass jar used for collecting constituent wastewater samples was decontaminated between successive sampling points in accordance with the procedures outlined in Section 4.1.1. New nylon cord was used for each sample.

##### 4.1.3.6.2 Sediment

The sediment sample analyzed from SWMUs 10 and 11 was a composite sample collected by mixing 3 aliquots of sediment from separate sampling locations. First a ponar dredge was used to collect sediment from the SWMU. A sample aliquot was taken from the dredging with a stainless steel trowel and placed in a stainless steel mixing bowl. The process was repeated for the two other sampling locations at SWMUs 10 and 11. The three aliquots were then thoroughly mixed and placed in sample bottles. For VOC analyses, grab samples were taken at one location in the SWMU directly from the ponar dredge and placed in clean sample bottles.

The stainless steel trowel, ponar dredge, and stainless steel mixing bowl were decontaminated between sampling locations in accordance with the procedures described in Section 4.1.1.

#### 4.1.3.7 SWMU 12 - Pipe Mill Oil Separator

##### 4.1.3.7.1 Wastewater

The wastewater sample from SWMU 12 was a composite sample collected by mixing 2 aliquots of wastewater from separate sampling locations. Each wastewater aliquot was collected using a clean glass jar immersed into the water by nylon cord. The aliquots, except those to be analyzed for dissolved metals, were poured directly into a sample bottles. Samples to be analyzed for dissolved metals were pumped from the glass jar through a 0.45-micron filter directly into a sampling bottle containing the proper preservative. A peristaltic pump with new tygon tubing attached for each sample was used in the filtering process. Samples for VOC analysis were taken at one location and poured directly from the glass jar into the preserved sampling vials.

The glass jar used for collecting wastewater samples was decontaminated between successive sampling points in accordance with the procedures outlined in Section 4.1.1. New nylon cord was used for each sample.

##### 4.1.3.7.2 Oil

Two aliquots of oil from SWMU 12 were taken by peristaltic pump from different locations within the upper 6 inches of the liquid in the tank. Both aliquots of oil were composited in a sample bottle.

#### 4.1.3.8 SWMU 13 - Pipe Mill Expander Pit

##### 4.1.3.8.1 Wastewater

The wastewater sample from SWMU 13 was a composite sample collected at one sampling location. The wastewater sample was collected using a clean glass jar immersed into the water by nylon cord. The water samples, except for those to be analyzed for dissolved metals, were poured directly into sample bottles containing the proper preservative. Samples to be analyzed for dissolved metals were pumped from the glass jar through a 0.45-micron filter directly into a sampling bottle containing the proper preservative. A peristaltic pump with new tygon tubing attached for each sample was used in the filtering process. Samples for VOC analysis were taken at one location and poured directly from the glass jar into the preserved sampling vials.

The glass jar used for collecting constituent wastewater samples was decontaminated between successive sampling points in accordance with the procedures outlined in Section 4.1.1. New nylon cord was used for each sample.

##### 4.1.3.8.2 Sediment

The sediment sample from SWMU 13 was collected at one location using a ponar dredge. The sample was taken from the dredging with a stainless steel trowel and placed directly into sampling bottles.

The sediment sample was not composited from three locations as required by the RFI Work Plan because of difficulty in accessing additional locations in the pit. Dames & Moore believes the sample collected adequately represents the sediment in the SWMU because identical processes produce the sediment.

#### 4.1.3.9 SWMUs 14, 15, 16 - 28-Inch, 35-Inch, and 44-Inch Rolling Mill Scale Pits

##### 4.1.3.9.1 Wastewater

One wastewater grab sample was collected and analyzed at each SWMU. An overhead crane was used to remove the steel floor plates covering SWMUs 14, 15, and 16. Wastewater samples were collected using a clean glass jar immersed into the water by nylon cord. The water samples, except those to be analyzed for dissolved metals, were poured directly into sample bottles containing the proper preservative. Samples to be analyzed for dissolved metals were pumped from the glass jar through a 0.45-micron filter directly into a sampling bottle containing the proper preservative. A peristaltic pump with new tygon tubing attached for each sample was used in the filtering process. Samples for VOC analysis were taken at one location and poured directly from the glass jar into the preserved sampling vials.

The glass jar used for collecting constituent wastewater samples was decontaminated between successive sampling points in accordance with the procedures outlined in Section 4.1.1. New nylon cord was used for each sample.

##### 4.1.3.9.2 Sediment

To gain entrance to the pits, an overhead crane was used to remove the steel floor plates covering SWMUs 14, 15, and 16. A clamshell bucket was then used to collect sediment from the pits. For each SWMU, the non-VOC sediment sample was composed of three aliquots taken from different locations in the clamshell bucket. A sample aliquot was taken from near the center of the bucket with a stainless steel trowel and placed in a stainless steel mixing bowl. The process was repeated for the other two aliquots. The three aliquots were then thoroughly mixed and placed in sample bottles. The samples for VOC analyses were taken directly from the bucket and placed in sample bottles.

The stainless steel trowel, and stainless steel mixing bowl were decontaminated between sampling locations in accordance with the procedures described in Section 4.1.1.

#### 4.1.3.10 SWMU 25 - Steel Foundry Electric Furnace Baghouse Bin

Samples were collected by scooping waste dust with a stainless steel trowel and placing the dust directly into a sample bottle. The stainless steel trowel was decontaminated between each sampling location as described in Section 4.1.1.

#### 4.1.3.11 SWMU 29 - Frog and Switch grinder Cyclone Holding Room

During the sampling investigation, it was not possible to sample the waste directly from the Frog and Switch Grinder Cyclone Holding Room. The dust collection ductwork had been rerouted, so no dust was available at this location for sampling. Alternatively, the dust sample was taken at the fan intake, directly adjacent to the Grinder Cyclone. Because the dust should be identical in both locations, Dames & Moore believes this sample adequately represents the wastes managed in SWMU 29. Samples were collected by scooping waste dust with a stainless steel trowel and placing the sample directly into a sample bottle.

#### 4.1.3.12 SWMUs 31 and 32 - Caustic Waste Rinsewater Tanks

The wastewater sample analyzed from SWMUs 31 and 32 was a composite sample collected by mixing two aliquots of wastewater, one from each SWMU. A thin layer of oil floating on the surface of the wastewater was not sampled. A peristaltic pump and tygon tubing were used to collect the samples. Aliquots of wastewater from each tank were composited in a glass jar. The water was pumped from the glass jar through a disposable 0.45-micron filter into the sampling bottle for dissolved metals analysis. New tubing was inserted in the pump prior to collection of the first sample, but was not replaced between sampling events because the wastewaters were derived from the same waste stream.

### 4.1.4 Test Pit Sampling Procedures

#### 4.1.4.1 Soil Sampling

Samples of soil were collected from test pits at the applicable SWMUs to assess whether PCOCs were released from the SWMUs. Four separate soil samples were collected at successive 6-inch intervals at each pit. The test pit lithologic logs are included in Appendix E and describe the soil color, composition, consistency, moisture, and classification. As specified in the RFI Work Plan, water samples were to be collected if standing water was present in the test pit.

Soil samples were collected from test pits near the following SWMUs:

SWMUs 1, 2, and 3	Wastewater Settling Basins
SWMUs 5, 6, and 7	Wastewater Treatment Lagoons
SWMU 8	Wastewater Polishing Lagoon
SWMU 9	Central Waste Oil Storage Tank
SWMU 10, 11	Continuous Caster Heavy Scale Pit and Fine Scale Pit
SWMU 12	Pipe Mill Oil Separator
SWMUs 20 and 21	HWM3 Pelletizer and Pelletizer Runoff Tank
SWMU 22	No. 2 Pelletizer
SWMU 24	EAF Spray Chambers Drop Legs
SWMU 25	Steel Foundry Electric Furnace Baghouse Bin
SWMU 29	Frog and Switch Grinder Cyclone Holding Room
SWMUs 30 and 31	Caustic Waste Rinsewater Tanks

The locations of test pits are given on Figures 4 through 14.

Samples of soil were collected from test pits at depths of 6 inches, 12 inches, 18 inches, and 24 inches. The upper 6 inches of soil were removed from a 3-foot by 4-foot area using a stainless steel shovel. A jackhammer was used to penetrate asphalt where present at the surface and loosen compacted soil at deeper intervals. Disturbed soil was removed from the pits with a decontaminated stainless steel shovel. At each sample depth, a sample of undisturbed soil was collected from the base of the pit with a stainless steel trowel and placed directly into the sample bottles.

The jackhammer blade, the shovel, and the trowel were decontaminated between sample locations as described in Section 4.1.1.

#### 4.1.4.2 Ground Water Sampling

No standing water was encountered in any of the test pits. Therefore, no ground water samples were collected.

#### 4.1.5 Canal Sampling Procedures

Samples of water and sediment were collected from the plant canal to determine the presence or absence of PCOCs in the canal. One round of water sampling was conducted during normal flow conditions on April 24 and 25, 1990, and a second round of water sampling was conducted on March 30, 1990, during increased flow following a storm.

##### 4.1.5.1 Surface Water Sampling

Surface water sampling points along the canal were located at the inlet and outlet, and at 1,500-foot intervals between these points for a total of 10 monitoring points labeled  $C_1$  to  $C_{10}$  (Figure 3). Water samples collected during normal flow conditions were composite samples. Each composite sample consisted of three aliquots of water collected at the monitoring point at three different times that day. A rowboat was used to collect the samples from the middle of the canal at the lower section of the stream (Samples  $C_1$  to  $C_6$ ). Water samples from the upper section ( $C_7$  to  $C_{10}$ ) were collected from the bank. Samples were collected from the boat by immersing a glass jar in the canal water. The samples were collected from the bank by immersing a glass jar by nylon cord into the canal water. Aliquots of water were transferred from the glass jar directly into the sampling bottles containing the proper preservatives.

Prior to sampling at each location, the glass jars were decontaminated as described in Section 4.1.1. New nylon cord was used at each sample location.

Surface water samples collected the day after a storm were taken along the bank of the canal. These water samples were grab samples poured directly into the sample bottles.

##### 4.1.5.2 Sediment Sampling

One round of sediment samples was collected at the ten canal monitoring points during normal flow conditions on April 20, 1990. Sediment samples were collected with a ponar dredge. A stainless steel trowel was used to transfer the samples from the dredge directly into the appropriate sample bottles. The stainless steel trowel and ponar dredge were decontaminated between each sampling location as described in Section 4.1.1.



#### 4.1.6 EP Toxicity Sample Selection Method

This section describes the method that was used to decide which soil and sediment samples were to be analyzed for Extraction Procedure Toxicity (EP Tox) metals. The RFI Work Plan identified the following samples from the respective SWMUs as possibly requiring EP Tox metals analysis:

- SWMU 1 - Constituent sediment and test pit soil samples
- SWMU 2 - Constituent sediment and test pit soil samples
- SWMU 3 - Constituent sediment and test pit soil samples
- SWMU 5 - Constituent sediment and test pit soil samples
- SWMU 6 - Constituent sediment and test pit soil samples
- SWMU 7 - Constituent sediment and test pit soil samples
- SWMU 8 - Constituent sediment and test pit soil samples
- SWMU 9 - Test pit soil samples
- SWMU 10 - Constituent sediment samples
- SWMU 11 - Constituent sediment samples
- SWMU 12 - Test pit soil samples
- SWMU 13 - Constituent sediment samples
- SWMU 14 - Constituent sediment samples
- SWMU 15 - Constituent sediment samples
- SWMU 16 - Constituent sediment samples
- SWMU 29 - Constituent sediment and test pit soil samples

The RFI Work Plan states that EP Toxicity (EP Tox) analysis would be performed only for metal whose total concentrations exceeded the EP Tox regulatory levels. Dames & Moore's method of selecting samples for EP Tox analysis, as described below, was discussed with, and received the approval of, Mr. Thomas Buntin of the USEPA on July 9, 1990, before selected samples were analyzed. Only those metals specified in Tables 6-2 and 6-4 of the RFI Work Plan (See Volume 1) that had EP Tox regulatory values were examined; therefore, aluminum, iron, and zinc were excluded.

Samples were submitted for EP Tox analysis if the results of  $V \div 20$  ( $V$  = total concentration of the target metal in soil expressed in mg/kg) was greater than the EP Tox regulatory value for that metal. The formula is based on the worst-case scenario of all metal detected in the soil sample leaching into the extraction fluid. The derivation of this formula is explained below.

The EP Tox procedure involves placing 100 grams (g) of the sediment or soil into 2 liters of extraction fluid. Therefore, the maximum quantity of metal in the 100-gram sample that could be leached out is:

$$V \text{ mg/kg} \times 100 \text{ grams}$$

This can be reduced as:

$$V \text{ mg/kg} \times 100 \text{ grams} \times (1 \text{ kg} \div 1,000 \text{ g}) = 0.1 (V) \text{mg.}$$

This quantity of metal would be dissolved in 2 liters of extraction fluid. Therefore, the maximum concentration of metal in the extraction fluid would be:

$$0.1(V) \text{mg} \div 2 \text{ liters} = V \div 20 \text{ mg/l}$$

Thus, if  $V \div 20$  is less than the EP Toxicity regulatory value, the concentration of metal in the extraction fluid will remain below the EP Tox regulatory concentration even if all the metal detected in the soil sample was dissolved in the fluid. An example would be as follows.

If the concentration of chromium in the 6-inch soil sample from SWMU 7 = 92 mg/kg, then the maximum EP Toxicity value for that sample equals  $92 \div 20$  or 4.6 mg/l. Because this maximum value is less than the EP Tox regulatory limit of 5.0 mg/l, this sample would not be submitted for EP Tox analysis.

## 4.2 CONSTITUENT SAMPLING AND SOIL INVESTIGATION RESULTS

### 4.2.1 SWMU 1 - Wastewater Settling Basin

#### 4.2.1.1 Constituent Sampling Results

##### 4.2.1.1.1 Sampling Locations

This SWMU is the easternmost lagoon south of the Rail Mills, as shown on Figure 1. Two rounds of water sampling and one round of sediment sampling were conducted at SWMU 1. One composite water sample and one composite sediment sample were analyzed each round. Each was a sample collected from three locations, (the middle and both ends of the lagoon as shown in Figure 4). Two grab samples of water and one of sediment were taken per round to be analyzed for VOCs.

##### 4.2.1.1.2 Wastewater Results

Constituent sampling results in Table 4-1 show the concentrations of PCOCs detected in wastewater samples from SWMU 1. A sheen of oil was observed floating on the surface of the settling basin, and some of this sheen was entrained with the water in the sample bottle submitted for analysis.

No target volatile organic compounds or dissolved metals were detected in the water at concentrations above the respective National Primary and Secondary Drinking Water Standards (NPDWS and NSDWS, respectively). No polynuclear aromatic hydrocarbons were detected in the water.

##### 4.2.1.1.3 Sediment Results

Constituent sampling results in Table 4-1 show the concentrations of PCOCs detected in sediment samples from SWMU 1. The sediment was fine-grained, dark black in color, and had an oily texture.

Based on results of analysis for total metals, shown on Table 4-1, and using the selection method discussed in Section 4.1.1, the sediment sample was also analyzed for chromium and lead by the EP Toxicity Procedure. As shown in Table 4-1, EP Toxicity concentrations of chromium and lead were below the regulatory levels.

#### 4.2.1.2 Soil Investigation Results

Because PCOCs were detected in the sediment of the SWMU, a soil investigation was conducted as proposed in the RFI Work Plan. The historical investigation indicated a potential for the release of PCOCs from SWMU 1 during dredging activities. Surface staining had been observed south of the containment pad adjacent to the eastern edge of the lagoon. To evaluate the stained area, a test pit was excavated at the location shown on Figure 4. The soil consisted predominantly of sand and some silt. No hydrocarbon odor was noted below 6 inches. Test pit logs are included in Appendix E. No water was encountered during excavation of the test pit.

Analytical results for soil samples collected from the test pit at 6, 12, 18, and 24 inches below the surface are shown on Table 4-1. No VOCs were detected in any of the soil samples. PAHs and TPH were detected. Their concentrations generally decreased with depth.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

#### 4.2.2 SWMU 2 and 3 - Wastewater Settling Basins

##### 4.2.2.1 Constituent Sampling Results

###### 4.2.2.1.1 Sampling Locations

One round of water and sediment sampling was conducted at the combined SWMU consisting of the middle lagoon (SWMU 2) and westernmost lagoon (SWMU 3) located south of the Rail Mills (Figure 4). One water and one sediment sample were analyzed. Each was a composite sample collected from six locations: the middle and both ends of each lagoon, as shown in Figure 4. One grab sample of water and one of sediment was taken from SWMU 2 per round. These were analyzed for VOCs.

###### 4.2.2.1.2 Wastewater Results

Constituent sampling results for SWMUs 2 and 3 are shown in Table 4-2. An oil sheen was observed floating on the surface of the water in the settling basins.

No targeted VOCs, PAHs, or dissolved metals were detected in the water at concentrations above the respective NPDWS and NSDWS.

###### 4.2.2.1.3 Sediment Results

Constituent sampling results for SWMUs 2 and 3 are shown in Table 4-2. The sediment or sludge from the basins was fine-grained, dark black in color, and had an oily texture.

Based on the results of total metal analysis shown on Table 4-2, the sediment sample was also analyzed for chromium and lead by the EP Toxicity Procedure. As shown in Table 4-2, EP Toxicity concentrations of chromium and lead were below the regulatory levels.

##### 4.2.2.2 Soil Investigation Results

Because PCOCs were detected in the sediment of the SWMUs, a soil investigation was conducted as proposed in the RFI Work Plan. The historical investigation indicated a potential for the release of PCOCs from SWMUs 2 and 3 during dredging activities. Surface staining had been observed between the southwestern edge of the

**Table 4-1**  
**SWMU 1 - WASTEWATER SETTLING BASINS**

PARAMETERS	WATER	SEDIMENT	EP TOXICITY SEDIMENT	SOIL INVESTIGATION				EP TOXICITY SOIL			
SAMPLE DEPTH				6"	12"	18"	24"	6"	12"	18"	24"
<b>VOLATILE ORGANICS</b>	(ug/l)	(ug/kg)	(mg/l)	(ug/kg)				(mg/l)			
Benzene	2 J/-	-	NA	-	-	-	-	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Ethylbenzene	NA	-	NA	-	-	-	-	NA	NA	NA	NA
Napthalene	-/-	NA	NA	-	-	-	-	NA	NA	NA	NA
Styrene	NA	-	NA	-	-	-	-	NA	NA	NA	NA
Toluene	-/-	-	NA	-	-	-	-	NA	NA	NA	NA
Xylene	NA	240 J	NA	-	-	-	-	NA	NA	NA	NA
<b>PAH</b>	(ug/l)	(ug/kg)	(mg/l)	(ug/kg)				(mg/l)			
Acenaphthene	NA	730 K	NA	-	-	-	-	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Anthracene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	2500 J	-	-	-	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	2400 J	-	-	-	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	3600 J	-	-	-	NA	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	2400 J	-	-	-	NA	NA	NA	NA
Chrysene	NA	-	NA	4700 J	-	-	-	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Fluoranthene	NA	1600 K	NA	8100 J	-	-	-	NA	NA	NA	NA
Fluorene	NA	1500 K	NA	-	-	-	-	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
2-Methylnaphthalene	NA	2100 K	NA	-	-	50 J	-	NA	NA	NA	NA
Napthalene	NA	1100 K	NA	-	-	37 J	-	NA	NA	NA	NA
Phenanthrene	NA	4300 K	NA	4000 J	-	-	-	NA	NA	NA	NA
Pyrene	NA	1900 K	NA	6700 J	-	-	-	NA	NA	NA	NA
<b>METALS</b>	(ug/l)	(ug/kg)	(mg/l)	(mg/kg)				(mg/l)			
Aluminum	-/-	2900	NA	6300 J	4500	5800	3400	NA	NA	NA	NA
Arsenic (5) +	NA	22	NA	5.6	4.6	4.7	4.1	NA	NA	NA	NA
Cadmium	NA	4	NA	0.8	-	-	-	NA	NA	NA	NA
Chromium (5) +	NA	520	.07	53	8-	31	15	NA	NA	NA	NA
Iron	0.29 B/0.19	350000	NA	1600 J	1400	19000	45000	NA	NA	NA	NA
Lead (5) +	NA	360	.52	5	8.4	20	8.3	NA	NA	NA	NA
Selenium	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Zinc	0.04 B/-	970	NA	97	38	48	86	NA	NA	NA	NA
<b>TPH</b>	(ug/l)	(ug/kg)	(mg/l)	(mg/kg)				(mg/l)			
	23/38	76000	NA	9400	550	62	380	NA	NA	NA	NA

SWMU 3 basin and the railroad tracks as shown in Figure 4. To evaluate the stained area, a test pit was excavated at the location shown on Figure 4. Soil at this location consisted of sand and silt (boring log in Appendix E). No water was encountered during excavation of the test pit.

Analytical results for soil samples collected from the test pit at 6, 12, 18, and 24 inches are shown in Table 4-2. Based on the results of the total metals analysis shown in Table 4-2, the 6-inch and the 24-inch soil sample were analyzed for chromium by the EP Toxicity procedure. As shown in Table 4-2, EP Toxicity concentrations of chromium in the samples were below the regulatory level.

**Table 4-2**  
**SWMUs 2 & 3**  
**WASTEWATER SETTLING BASINS**

PARAMETERS	WATER	SEDIMENT	EP TOXICITY SEDIMENT	SOIL INVESTIGATION				EP TOXICITY SOIL			
SAMPLE DEPTH				6"	12"	18"	24"	6"	12"	18"	24"
<b>VOLATILE ORGANICS</b>	(ug/l)	(ug/kg)	(mg/l)	(ug/kg)				(mg/l)			
Benzene	2 J	-	NA	-	-	-	-	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Ethylbenzene	NA	-	NA	-	-	-	-	NA	NA	NA	NA
Styrene	NA	-	NA	-	-	-	-	NA	NA	NA	NA
Toluene	-	24	NA	5	3	2	2	NA	NA	NA	NA
Xylene	NA	12 J	NA	3	-	-	-	NA	NA	NA	NA
<b>PAH</b>	(ug/l)	(ug/kg)	(mg/l)	(ug/kg)				(mg/l)			
Acenaphthene	NA	-	NA	-	-	-	-	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	43 J	-	-	-	NA	NA	NA	NA
Anthracene	NA	NA	NA	47 J	-	-	50 J	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	190 J	63 J	210 J	150 J	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	160 J	-	160 J	-	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	290 J	75 J	280 J	140 J	NA	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	190 J	38 J	120 J	95 J	NA	NA	NA	NA
Chrysene	NA	-	NA	270 J	97 J	230 J	150 J	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Fluoranthene	NA	-	NA	290 J	110 J	300 J	350 J	NA	NA	NA	NA
Fluorene	NA	930 K	NA	-	-	-	-	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
2-Methylnaphthalene	NA	2100 K	NA	63 J	33 J	50 J	57 J	NA	NA	NA	NA
Napthalene	2 J	1000 B	NA	57 J	-	40 J	47 J	NA	NA	NA	NA
Phenanthrene	NA	2400 K	NA	150 J	40 J	73 J	230 J	NA	NA	NA	NA
Pyrene	NA	-	NA	670 J	130 J	440 J	340 J	NA	NA	NA	NA
<b>METALS</b>	(ug/l)	(ug/kg)	(mg/l)	(mg/kg)				(mg/l)			
Aluminum	-	450	NA	13000	4800	3900	7600	NA	NA	NA	NA
Arsenic (5) +	NA	52	NA	3.4	4.4	4.9	6.1	NA	NA	NA	NA
Cadmium	NA	-	NA	-	-	-	-	NA	NA	NA	NA
Chromium (5) +	NA	470	-	1300	11	23	120	.37	NA	NA	-
Iron	0.22 B	480000	NA	63000	12000	13000	35000	NA	NA	NA	NA
Lead (5) +	NA	260 J	.11	49	7.4	13	32	NA	NA	NA	NA
Selenium	NA	NA	NA	0.6	-	-	-	NA	NA	NA	NA
Zinc	0.04 B	49	NA	110	38	48	70	NA	NA	NA	NA
<b>TPH</b>	(ug/l)	(ug/kg)	(mg/l)	(mg/kg)				(mg/l)			
	55	31000	NA	1000	37	300	30	NA	NA	NA	NA

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

#### 4.2.3 SWMU 5, 6, 7 - Wastewater Treatment Lagoons

##### 4.2.3.1 Constituent Sampling Results

##### 4.2.3.1.1 Sampling Locations

One round of water and sediment sampling was conducted at SWMUs 5, 6, and 7, a series of three lagoons located northeast of the boiler building and southeast of Front Street (Figure 1). Each was a composite sample collected from nine locations (the middle and both ends of each of the three lagoons, as shown in Figure 5). Also, one grab sample of water and one of sediment were taken from SWMU 5. These were analyzed for VOCs.

##### 4.2.3.1.2 Wastewater Results

Sampling results for the composite SWMU 5, 6, and 7 sample are shown in Table 4-3. A light-brown oil sheen was observed floating on the water.

No targeted dissolved metals were detected in the water at concentrations above the respective NPDWS and NSDWS. No targeted VOCs or PAHs were detected in the water.

##### 4.2.3.1.3 Sediment Results

Sampling results for the composite SWMU 5, 6, and 7 sediment sample are shown in Table 4-3. The sediment in the lagoons was fine-grained, dark brown to black in color, and had a oily texture.

**Table 4-3**  
**SWMUs 5, 6 & 7**  
**WASTEWATER POLISHING LAGOONS**

PARAMETERS	WATER	SEDIMENT	EP TOXICITY SEDIMENT
<b>VOLATILE ORGANICS</b>	(ug/l)	(ug/kg)	(mg/l)
Benzene	-	-	NA
Chlorobenzene	NA	NA	NA
Ethylbenzene	NA	-	NA
Napthalene	-	NA	NA
Styrene	NA	-	NA
Toluene	-	27 J	NA
Xylene	NA	-	NA
<b>PAH</b>	(ug/l)	(ug/kg)	(mg/l)
Acenaphthene	NA	-	NA
Acenaphthylene	NA	NA	NA
Anthracene	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA
Chrysene	NA	-	NA
Dibenz(a,h)anthracene	NA	NA	NA
Fluoranthene	NA	1500 K	NA
Fluorene	NA	-	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA
2-Methylnapthalene	NA	-	NA
Napthalene	NA	-	NA
Phenanthrene	NA	1100 K	NA
Pyrene	NA	1500 K	NA
<b>METALS</b>	(ug/l)	(ug/kg)	(mg/l)
Aluminum	-	2600	NA
Arsenic (S) *	NA	21	NA
Cadmium	NA	1.2	NA
Chromium (S) *	NA	230	.12
Iron	0.19	190000	NA
Lead (S) *	NA	370	2.3
Selenium	NA	NA	NA
Zinc	0.03 B	270	NA
<b>TPH</b>	(ug/l)	(ug/kg)	(mg/l)
	17	45000	NA

Based on the results of analyses for total metals as shown in Table 4-3, the constituent sediment sample was analyzed for chromium and lead by EP Toxicity Procedures. As shown in Table 4-3, concentrations of chromium and lead in the EP leachate were below their respective regulatory levels.

##### 4.2.3.2 Soil Investigation Results

Because PCOCs were detected in the sediments of the SWMUs, a soil investigation was conducted as proposed in the RFI Work Plan. The historical investigation indicated a potential for the release of oil from the oil skimmers before secondary containment improvements were constructed in 1987 or 1988. In accordance with the March 12, 1990, Modifications to the Scope of the Field Investigation for the RFI Work Plan (included in Volume 1) and to

evaluate whether a release had occurred at the oil skimmers, test pits were excavated at the locations shown on Figure 5. To evaluate whether a release had occurred during dredging of the lagoons, a test pit was also excavated in areas of surface staining on the northeast edge of the concrete loading pad at each lagoon. Soil in all six test pits was fill material consisting of sand, silt, and gravel with brick and slag fragments. Test pit logs are included in Appendix E. No water was encountered during excavation of any of the test pits.

In accordance with the March 12, 1990, modifications to the RFI Work Plan, soil samples from the test pits at each oil skimmer were analyzed for TPH only. Soil samples from the other test pits were analyzed for TPH, PAH, VOCs, total metals, and selected EP Toxicity metals.

Concentration of TPH in soil samples collected from the test pit at the SWMU 5 oil skimmer at 6-, 12-, 18-, and 24-inch depths are shown in Table 4-4. Concentrations of TPH in four samples collected from the test pit at the SWMU 6 oil skimmer are shown in Table 4-5. Concentrations of TPH in four samples collected from the test pit at the SWMU 7 oil skimmer are shown in Table 4-6.

Analytical results for the soil samples collected from the test pit at the SWMU 5 lagoon, located in an area of surface staining, are also shown in Table 4-4. Based on the results of total metals analysis shown on Table 4-4, all four soil samples were analyzed for chromium and lead by EP Toxicity Procedures. As shown in Table 4-4, concentrations of chromium and lead in the EP leachate in all SWMU 5 lagoon samples were below the respective regulatory levels.

Analytical results for the soil samples collected from the test pit at the SWMU 6 lagoon are shown in Table 4-5. Based on the results of total metals analysis for the lagoon test pit shown in Table 4-5, the 12- and 24-inch samples were analyzed for chromium and all samples were analyzed for lead by the EP Toxicity Procedure. EP Toxicity concentrations of lead and chromium in SWMU 6 lagoon samples were below the respective regulatory levels.

**Table 4-4**  
**SWMU 5**  
**WASTEWATER TREATMENT LAGOON**

PARAMETERS	SOIL INVESTIGATION				EP TOXICITY SOIL			
	6"	12"	18"	24"	6"	12"	18"	24"
<b>VOLATILE ORGANICS</b>	(ug/kg)				(mg/l)			
Benzene	-	-	-	-	NA	NA	NA	NA
Chlorobenzene	-	-	-	-	NA	NA	NA	NA
Ethylbenzene	-	-	-	-	NA	NA	NA	NA
Styrene	-	-	-	-	NA	NA	NA	NA
Toluene	-	-	-	2	NA	NA	NA	NA
Xylene	-	-	-	5	NA	NA	NA	NA
<b>PAH</b>	(ug/kg)				(mg/l)			
Acenaphthene	-	-	-	-	NA	NA	NA	NA
Acenaphthylene	67 J	240 J	160 J	87 J	NA	NA	NA	NA
Anthracene	110 J	390 J	230 J	140 J	NA	NA	NA	NA
Benzo(a)anthracene	940	4900	2500	1100	NA	NA	NA	NA
Benzo(a)pyrene	880	3700	2300	1000	NA	NA	NA	NA
Benzo(b)fluoranthene	1200	5500	2300	1400	NA	NA	NA	NA
Benzo(ghi)perylene	440	1600	1000	540 J	NA	NA	NA	NA
Benzo(k)fluoranthene	770	2800	2200	1500	NA	NA	NA	NA
Chrysene	1100	5000	3100	1600	NA	NA	NA	NA
Dibenz(a,h)anthracene	80 J	410 J	280 J	-	NA	NA	NA	NA
Fluoranthene	1200	6000	3300	1500	NA	NA	NA	NA
Fluorene	-	-	-	-	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	470	19000	1200	570 J	NA	NA	NA	NA
2-Methylnaphthalene	150 J	490 J	310 J	150 J	NA	NA	NA	NA
Naphthalene	440	1300	970	320 J	NA	NA	NA	NA
Phenanthrene	570	1900	1100	750	NA	NA	NA	NA
Pyrene	1400	6500	4000	2100	NA	NA	NA	NA
<b>METALS</b>	(mg/kg)				(mg/l)			
Aluminum	6000	6200	3700	4500	NA	NA	NA	NA
Arsenic (S) *	7.8	9.2	6.5	7.2	NA	NA	NA	NA
Cadmium	1.2	1.9	0.7	0.9	NA	NA	NA	NA
Chromium (S) *	320	280	290	260	-	.08	.14	.1
Iron	63000	70000	69000	62000	NA	NA	NA	NA
Lead (S) *	150	260	120	150	.04	.08	.24	.2
Selenium	-	-	-	-	NA	NA	NA	NA
Zinc	380 J	420 J	250 J	250 J	NA	NA	NA	NA
<b>TPH</b>	(mg/kg)				(mg/l)			
<b>LAGOON</b>	460	210	680	1300	NA	NA	NA	NA
<b>SKIMMER</b>	4600	2200	2700	3900	NA	NA	NA	NA

Analytical results for the soil samples collected from the test pit at the SWMU 7 lagoon are shown in Table 4-6. Based on the results of total metals analysis shown on Table 4-6, soil samples from 18 and 24 inches were analyzed for chromium and soil samples from 6, 12, and 18 inches were analyzed for lead by EP Toxicity procedures. As shown in Table 4-6, concentrations of lead and chromium in the EP leachate were below regulatory levels.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

#### 4.2.4 SWMU 8 - Wastewater Polishing Lagoon

##### 4.2.4.1 Constituent Sampling Results

##### 4.2.4.1.1 Sampling Locations

One round of water and sediment sampling was conducted at SWMU 8, located northeast and downhill from SWMU 5 (Figure 1). Each water and sediment sample analyzed (except those collected for VOC analysis) was a composite sample collected from three locations (the middle and both ends of the lagoon), as shown in Figure 6. In addition, one grab sample of water and one of sediment were taken and analyzed for VOCs.

Constituent sampling results for SWMU 8 are shown in Table 4-7.

##### 4.2.4.1.2 Wastewater Results

No targeted dissolved metals were detected in the water at concentrations above the respective NPDWS and NSDWS. No targeted VOCs or PAHs were detected in the water.

##### 4.2.4.1.3 Sediment Results

Constituent sampling results for SWMU 8 are shown in Table 4-7.

**Table 4-5  
SWMU 6  
WASTEWATER TREATMENT LAGOON**

PARAMETERS	SOIL INVESTIGATION				EP TOXICITY SOIL			
	6"	12"	18"	24"	6"	12"	18"	24"
<b>VOLATILE ORGANICS</b>	(ug/kg)				(mg/l)			
Benzene	-	-	-	-	NA	NA	NA	NA
Chlorobenzene	-	-	-	-	NA	NA	NA	NA
Ethylbenzene	-	-	-	-	NA	NA	NA	NA
Styrene	-	-	-	-	NA	NA	NA	NA
Toluene	3	-	4	5	NA	NA	NA	NA
Xylene	6	-	3	6	NA	NA	NA	NA
<b>PAH</b>	(ug/kg)				(mg/l)			
Acenaphthene	-	-	-	-	NA	NA	NA	NA
Acenaphthylene	-	-	-	-	NA	NA	NA	NA
Anthracene	-	-	-	73 J	NA	NA	NA	NA
Benzo(a)anthracene	480 J	450 J	690 J	650 J	NA	NA	NA	NA
Benzo(a)pyrene	620 J	520 J	660 J	820	NA	NA	NA	NA
Benzo(b)fluoranthene	810	560 J	900 J	520 J	NA	NA	NA	NA
Benzo(ghi)perylene	310 J	440 J	610 J	500 J	NA	NA	NA	NA
Benzo(k)fluoranthene	490 J	270 J	500 J	720	NA	NA	NA	NA
Chrysene	710	560 J	930 J	820	NA	NA	NA	NA
Dibenz(a,h)anthracene	-	-	-	110 J	NA	NA	NA	NA
Fluoranthene	630 J	350 J	670 J	710	NA	NA	NA	NA
Fluorene	-	-	-	-	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	350 J	370 J	-	410 J	NA	NA	NA	NA
2-Methylnaphthalene	200 J	170 J	130 J	210 J	NA	NA	NA	NA
Napthalene	190 J	150 J	140 J	210 J	NA	NA	NA	NA
Phenanthrene	370 J	270 J	360 J	470 J	NA	NA	NA	NA
Pyrene	650 J	450 J	840 J	870	NA	NA	NA	NA
<b>METALS</b>	(mg/kg)				(mg/l)			
Aluminum	4200	4100	5000	5500	NA	NA	NA	NA
Arsenic (5) *	7	12	7.2	7.7	NA	NA	NA	NA
Cadmium	0.9	1.5	1.4	1.2	NA	NA	NA	NA
Chromium (5) *	81	220	90	200	NA	.04	NA	.04
Iron	41000	56000	53000	75000	NA	NA	NA	NA
Lead (5) *	160	180	220	290	.8	.17	.30	.10
Selenium	-	-	-	-	NA	NA	NA	NA
Zinc	460 J	410 J	280 J	350 J	NA	NA	NA	NA
<b>TPH</b>	(mg/kg)				(mg/l)			
<b>LAGOON</b>	170	980	55	360	NA	NA	NA	NA
<b>SKIMMER</b>	63	51	53	20	NA	NA	NA	NA



Based on the results of total metal analysis shown in Table 4-7, the constituent sediment sample was analyzed for chromium and lead by EP Toxicity procedures. Concentrations of lead and chromium in the EP leachate were below regulatory levels.

#### 4.2.4.2 Soil Investigation Results

Because PCOCs were detected, a soil investigation was conducted as proposed in the RFI Work Plan. The historical investigation indicated a potential for the release of oil from the oil skimmer prior to the construction of secondary containment improvements in 1987 or 1988. In accordance with Modifications to the Field Investigation of the RFI Work Plan, a test pit was excavated adjacent to the SWMU 8 oil skimmer. Samples were analyzed for TPH. Another test pit was excavated along the northeast side of the lagoon, as shown in Figure 6. Soil samples from this test pit were analyzed for PAHs, VOCs, total metals, TPH and selected EP Toxicity metals. Soil at both test pit locations consisted of fill material containing sand, silt, gravel, and brick fragments (Appendix E). No water was encountered in either of the test pits.

TPH concentration for four soil samples from the SWMU 8 oil skimmer test pit are shown in Table 4-7.

Analytical results for the SWMU 8 lagoon test pit soil samples are shown in Table 4-7. Based on the results of total metals analysis shown on Table 4-7, the 12- and 24-inch samples were analyzed for lead by the EP Toxicity procedure. As shown in Table 4-7, concentrations of lead in the EP leachate were below the regulatory level.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

Table 4-6  
SWMU 7  
WASTEWATER TREATMENT LAGOON

PARAMETERS	SOIL INVESTIGATION				EP TOXICITY SOIL			
	6"	12"	18"	24"	6"	12"	18"	24"
<b>VOLATILE ORGANICS</b>	(ug/kg)				(mg/l)			
Benzene	-	-	-	-	NA	NA	NA	NA
Chlorobenzene	-	-	-	-	NA	NA	NA	NA
Ethylbenzene	-	-	-	-	NA	NA	NA	NA
Styrene	-	-	-	-	NA	NA	NA	NA
Toluene	-	3	-	5	NA	NA	NA	NA
Xylene	-	-	-	3	NA	NA	NA	NA
<b>PAH</b>	(ug/kg)				(mg/l)			
Acenaphthene	-	-	-	-	NA	NA	NA	NA
Acenaphthylene	-	-	-	67 J	NA	NA	NA	NA
Anthracene	-	67 J	67 J	250 J	NA	NA	NA	NA
Benzo(a)anthracene	410 J	570 J	470 J	2200 J	NA	NA	NA	NA
Benzo(a)pyrene	510 J	570 J	550 J	1500 J	NA	NA	NA	NA
Benzo(b)fluoranthene	690 J	850 J	830 J	2400 J	NA	NA	NA	NA
Benzo(ghi)perylene	600 J	-	-	1200 J	NA	NA	NA	NA
Benzo(k)fluoranthene	310 J	300 J	-	950 J	NA	NA	NA	NA
Chrysene	690	740 J	690 J	2500 J	NA	NA	NA	NA
Dibenz(a,h)anthracene	-	-	-	210 J	NA	NA	NA	NA
Fluoranthene	480 J	590 J	460 J	2200 J	NA	NA	NA	NA
Fluorene	-	-	-	-	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	570 J	480 J	-	1100 J	NA	NA	NA	NA
2-Methylnaphthalene	93 J	380 J	280 J	750 J	NA	NA	NA	NA
Naphthalene	160 J	250 J	210 J	790 J	NA	NA	NA	NA
Phenanthrene	300 J	530 J	420 J	1400 J	NA	NA	NA	NA
Pyrene	430 J	520 J	620 J	2600 J	NA	NA	NA	NA
<b>METALS</b>	(mg/kg)				(mg/l)			
Aluminum	4100	5200	6100	5400	NA	NA	NA	NA
Arsenic (5) *	4.5	7.7	9.7	9.1	NA	NA	NA	NA
Cadmium	1	0.8	1.4	1.6	NA	NA	NA	NA
Chromium (5) *	92	73	110	270	NA	NA	-	.05
Iron	54000	75000	76000	67000	NA	NA	NA	NA
Lead (5) *	.190	360	320	220	.17	.9	.06	NA
Selenium	-	-	-	-	NA	NA	NA	NA
Zinc	300 J	450 J	420 J	360 J	NA	NA	NA	NA
<b>TPH</b>	(mg/kg)				(mg/l)			
LAGOON	260	150	430	460	NA	NA	NA	NA
SKIMMER	70	43/56'	80	59	NA	NA	NA	NA

NOTES: ' = Duplicate sample

**Table 4-7**  
**SWMU 8**  
**WASTEWATER POLISHING LAGOON**

PARAMETERS	WATER	SEDIMENT	EP TOXICITY SEDIMENT	SOIL INVESTIGATION				EP TOXICITY SOIL			
SAMPLE DEPTH				6"	12"	18"	24"	6"	12"	18"	24"
<b>VOLATILE ORGANICS</b>	(ug/l)	(ug/kg)	(mg/l)	(ug/kg)				(mg/l)			
Benzene	-	-	NA	-	-	-	-	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Ethylbenzene	NA	760 J	NA	-	-	-	-	NA	NA	NA	NA
Styrene	NA	-	NA	-	-	-	4	NA	NA	NA	NA
Toluene	-	-	NA	-	-	-	-	NA	NA	NA	NA
Xylene	NA	7800 J	NA	-	-	-	6	NA	NA	NA	NA
<b>PAH</b>	(ug/l)	(ug/kg)	(mg/l)	(ug/kg)				(mg/l)			
Acenaphthene	NA	-	NA	-	-	-	-	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	-	93 J	-	-	NA	NA	NA	NA
Anthracene	NA	NA	NA	-	73 J	-	-	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	-	550 J	-	160 J	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	110 J	1500 J	83 J	270 J	NA	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	-	170 J	-	150 J	NA	NA	NA	NA
Chrysene	NA	1100 J	NA	87 J	980	53 J	230 J	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	-	-	-	-	NA	NA	NA	NA
Fluoranthene	NA	1500 J	NA	70 J	1100	63 J	220 J	NA	NA	NA	NA
Fluorene	NA	-	NA	-	-	-	-	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	-	290 J	-	-	NA	NA	NA	NA
2-Methylnaphthalene	NA	-	NA	-	380 (1)	47 J	210 (1)	NA	NA	NA	NA
Napthalene	-	7800	NA	-	480 J	67 J	340 J	NA	NA	NA	NA
Phenanthrene	NA	1100 J	NA	-	470 J	-	170 J	NA	NA	NA	NA
Pyrene	NA	1700 J	NA	63 J	970	63 J	180 J	NA	NA	NA	NA
<b>METALS</b>	(ug/l)	(ug/kg)	(mg/l)	(mg/kg)				(mg/l)			
Aluminum	-	2700	NA	3500	4700	15000	13000	NA	NA	NA	NA
Arsenic (S) *	NA	16	NA	4.3	14	86	68	NA	NA	NA	NA
Cadmium	NA	0.9	NA	0.6	1	3.2	2.8	NA	NA	NA	NA
Chromium (S) *	NA	150	-	18	43	42	73	NA	NA	NA	NA
Iron	.26	140000	NA	160000	150000	94000	120000	NA	NA	NA	NA
Lead (S) *	NA	250	.69	41	190	71	150	NA	NA	NA	NA
Selenium	NA	NA	NA	-	-	2.6	2.2	NA	.04	NA	NA
Zinc	0.04 B	240	NA	170	290	180	290	NA	NA	NA	NA
<b>TPH</b>	(ug/l)	(ug/kg)	(mg/l)	(mg/kg)				(mg/l)			
LAGOON	5.8	45000	NA	11 J	170 J	-	180 J	NA	NA	NA	NA
SKIMMER	NA	NA	NA	630 J	29 J	36 J	650	NA	NA	NA	NA

NOTES: (1) = Corrected value from Wadsworth laboratory memo dated November 1, 1990

#### 4.2.5 SWMU 9 - CENTRAL WASTE OIL STORAGE TANK SWMU 4 - SETTLING BASIN SUMP

##### 4.2.5.1 Constituent Sampling Results

As shown on Figure 1, the Central Waste Oil Storage Tank is located immediately south of the Wastewater Settling Basins (SWMUs 1, 2, and 3). It is surrounded by a concrete containment dike. An oil sample was collected from the tank and analyzed for selected total metals in accordance with the modifications to the Work Plan.

**Table 4-8**  
**SWMU 9**  
**CENTRAL WASTE OIL STORAGE TANK**

PARAMETERS	OIL	SOIL INVESTIGATION				EP TOXICITY SOIL			
SAMPLE DEPTH		6"	12"	18"	24"	6"	12"	18"	24"
<b>VOLATILE ORGANICS</b>	(ug/kg)	(ug/kg)				(mg/l)			
Benzene	NA	-	-	-	-	NA	NA	NA	NA
Chlorobenzene	NA	-	-	-	-	NA	NA	NA	NA
Ethylbenzene	NA	-	-	-	-	NA	NA	NA	NA
Styrene	NA	-	-	-	-	NA	NA	NA	NA
Toluene	NA	6	-	-	-	NA	NA	NA	NA
Xylene	NA	-	-	-	-	NA	NA	NA	NA
<b>PAH</b>	(ug/kg)	ug/kg				(mg/l)			
Acenaphthene	NA	-	-	-	-	NA	NA	NA	NA
Acenaphthylene	NA	-	-	-	-	NA	NA	NA	NA
Anthracene	NA	-	-	-	-	NA	NA	NA	NA
Benzo(a)anthracene	NA	-	-	-	-	NA	NA	NA	NA
Benzo(a)pyrene	NA	-	-	-	-	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	-	-	-	-	NA	NA	NA	NA
Benzo(ghi)perylene	NA	-	-	-	-	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	-	-	-	-	NA	NA	NA	NA
Chrysene	NA	-	-	-	-	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	-	-	-	-	NA	NA	NA	NA
Fluoranthene	NA	-	-	-	-	NA	NA	NA	NA
Fluorene	NA	-	-	-	-	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	-	-	-	-	NA	NA	NA	NA
2-Methylnaphthalene	NA	-	-	-	-	NA	NA	NA	NA
Napthalene	NA	-	-	-	-	NA	NA	NA	NA
Phenanthrene	NA	-	-	-	-	NA	NA	NA	NA
Pyrene	NA	-	-	-	-	NA	NA	NA	NA
<b>METALS</b>	(ug/kg)	(mg/kg)				(mg/l)			
Aluminum	61	4800	5000	8000	7500	NA	NA	NA	NA
Arsenic (5) *	-	9.5	8	13	15	NA	NA	NA	NA
Cadmium	-	1.2	1.6	1.7	1	NA	NA	NA	NA
Chromium (5) *	2.8	460	480	400	330	-	-	.07	.04
Iron	1000	67000	100000	82000	56000	NA	NA	NA	NA
Lead (5) *	7	220	200	560	160	.02	.03	.12	.06
Selenium	NA	-	-	-	-	NA	NA	NA	NA
Zinc	81	320	480	730	320	NA	NA	NA	NA
<b>TPH</b>	(ug/kg)	(mg/kg)				(mg/l)			
	NA	38000	26000	29000	27000	NA	NA	NA	NA

The constituent sampling results for SWMU 9 are presented on Table 4-8. The sample was not analyzed by the EP Toxicity procedure.

#### 4.2.5.2 Soil Investigation Results

Because PCOCs were detected in the oil, a soil investigation was conducted as proposed in the RFI Work Plan modifications. The historical investigation indicated a potential for the release of oil from SWMU 9 through spills during the unloading oil and tank overfilling. A test pit was excavated immediately southwest of the tank, adjacent to the containment pad and within the diked area, as shown in Figure 4. Soil consisted of sand and silt with a

hydrocarbon odor and oily texture (Appendix E, boring logs). No water was encountered during excavation of the test pit.

Analytical results for soil samples collected from the test pit at 6-, 12-, 18-, and 24-inch depths are shown in Table 4-8. It is important to note that although non-detects are reported for PAH soil data at this SWMU, the detection limits are as high as 27 mg/kg and it was not possible to determine surrogate recoveries. The high detection limits and surrogate failure are attributed to interferences associated with high TPH content in the soils.

Based on the results of total metals analyses, shown in Table 4-8, the samples at all four depths were analyzed for chromium and lead by EP Toxicity procedures. As shown in Table 4-8, concentrations of chromium and lead in the EP leachate for all four samples were below their respective regulatory levels.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

#### 4.2.6 SWMU 10 and 11 - Continuous Castor Heavy Scale Pit and Fine Scale Pit

##### 4.2.6.1 Constituent Sampling Results

###### 4.2.6.1.1 Sampling Locations

One round of water and sediment sampling was conducted at this SWMU. SWMU 10, 11 is located adjacent to the Caster Building and south of the Rail Mills, as shown in Figure 1. One water and one sediment sample were analyzed. Except for VOCs, each was a composite sample collected from three locations in the pits (one location in SWMU 10 and two locations in SWMU 11), as shown in Figure 7. One grab sample of water and one of sediment was taken from SWMU 10, 11 for VOC analysis.

###### 4.2.6.1.2 Wastewater Results

Constituent sampling results for SWMU 10, 11 are shown in Table 4-9. The water in the SWMU had a murky, medium-brown color. An oil sheen was observed in the water sample.

No targeted VOCs or PAHs were detected in the water. No targeted dissolved metals were detected in the water at levels above the NPDWS. Iron was detected in the water sample at 1.5 mg/l, which is above the NSDWS of 0.3 mg/l. Aluminum was detected in the water sample at 0.2 mg/l. No drinking water standard is available for aluminum. Wastewater of SWMU 10, 11 is discharged to one of three Wastewater Treatment Lagoons (SWMUs 5, 6 and 7) for further treatment, without worker intervention. Aluminum was not detected and the concentration of iron was below 0.3 mg/l in SWMUs 5, 6, and 7.

###### 4.2.6.1.3 Sediment Results

Constituent sampling results for SWMU 10, 11 are shown in Table 4-7. The sediment sample was composed of gray, oily, medium- and fine-grained iron scale.

Chromium is the only PCOC reported in the analytical results which was present at potentially hazardous levels. EP Toxicity testing was, therefore, performed for chromium. As shown in Table 4-9, the concentration of chromium found in the EP leachate was below the regulatory level. Thus, the sediments are not hazardous by characteristic.

**Table 4-9**  
**SWMUs 10 & 11**  
**CONTINUOUS CASTER HEAVY SCALE PIT AND FINE SCALE PIT**

PARAMETERS	WATER	SEDIMENT	EP TOXICITY SEDIMENT	SOIL INVESTIGATION			
SAMPLE DEPTH				6"	12"	18"	24"
<b>VOLATILE ORGANICS</b>	(ug/l)	(ug/kg)	(mg/l)	(ug/kg)			
Benzene	-	-	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	-	NA	NA	NA	NA	NA
Styrene	NA	-	NA	NA	NA	NA	NA
Toluene	-	-	NA	NA	NA	NA	NA
Xylene	NA	-	NA	NA	NA	NA	NA
<b>PAH</b>	(ug/l)	(ug/kg)	(mg/l)	(ug/kg)			
Acenaphthene	NA	-	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	-	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	-	NA	NA	NA	NA	NA
Fluorene	NA	-	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	-	NA	NA	NA	NA	NA
Naphthalene	-	-	NA	NA	NA	NA	NA
Phenanthrene	NA	-	NA	NA	NA	NA	NA
Pyrene	NA	-	NA	NA	NA	NA	NA
<b>METALS</b>	(ug/l)	(ug/kg)	(mg/l)	(mg/kg)			
Aluminum	0.2	5900	NA	NA	NA	NA	NA
Arsenic (5) *	NA	75	NA	NA	NA	NA	NA
Cadmium	NA	-	NA	NA	NA	NA	NA
Chromium (5) *	NA	660	.05	NA	NA	NA	NA
Iron	1.5	530000	NA	NA	NA	NA	NA
Lead (5) *	NA	23	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA
Zinc	0.08 B	43	NA	NA	NA	NA	NA
<b>TPH</b>	(ug/l)	(ug/kg)	(mg/l)	(mg/kg)			
	3.8	420	NA	520 J	180 J	230 J	80 J

#### 4.2.6.2 Soil Investigation Results

The historical investigation indicated a potential for release of oil from the SWMU during transfer of oil into an oil dumpster. In accordance with the modifications to the RFI Work Plan dated March 12, 1990, a test pit was excavated adjacent to the oil storage building and directly south of the oil dumpster in an area of surface staining, as shown in Figure 7. Soil at this location was of variable composition, with fill material consisting of sand and gravel in the western portion of the pit, and clay with some gravel in the eastern portion of the pit. The soil lithologies are shown in the boring logs (Appendix E). No water was encountered during excavation of the test pit. Soil samples from the test pit were analyzed for TPH.

Analytical results for soil samples collected from the test pit are shown in Table 4-9.

**Table 4-10**  
**SWMU 12**  
**PIPE MILL OIL SEPERATOR**

PARAMETERS	WATER	OIL	SOIL INVESTIGATION				EP TOXICITY SOIL			
SAMPLE DEPTH			6"	12"	18"	24"	6"	12"	18"	24"
<b>VOLATILE ORGANICS</b>	(ug/l)	(ug/kg)	(ug/kg)				(mg/l)			
Benzene	-	NA	-	-	-	-	NA	NA	NA	NA
Chlorobenzene	NA	NA	-	-	-	-	NA	NA	NA	NA
Ethylbenzene	NA	NA	-	-	-	-	NA	NA	NA	NA
Styrene	NA	NA	-	-	-	-	NA	NA	NA	NA
Toluene	-	NA	5 J	2 J	3 J	-	NA	NA	NA	NA
Xylene	NA	NA	3 B	-	8 B	5 B	NA	NA	NA	NA
<b>PAH</b>	(ug/l)	(ug/kg)	(ug/kg)				(mg/l)			
Acenaphthene	NA	NA	-	-	-	-	NA	NA	NA	NA
Acenaphthylene	NA	NA	-	-	4000 J	16000 J	NA	NA	NA	NA
Anthracene	NA	NA	-	-	8000 J	18000 J	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	2500 J	-	28000 J	78000 J	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	-	-	22000 J	60000 J	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	5000 J	-	35000 J	95000 J	NA	NA	NA	NA
Benzo(ghi)perylene	NA	NA	-	-	-	17000 J	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	2500 J	-	21000 J	56000 J	NA	NA	NA	NA
Chrysene	NA	NA	4000 J	-	32000 J	86000 J	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	-	-	-	-	NA	NA	NA	NA
Fluoranthene	NA	NA	7800 J	-	70000 J	200000 J	NA	NA	NA	NA
Fluorene	NA	NA	-	-	7300 J	11000 J	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	-	-	-	20000 J	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	-	-	-	5000 J	NA	NA	NA	NA
Napthalene	-	NA	-	-	6700 J	15000 J	NA	NA	NA	NA
Phenanthrene	NA	NA	2000 J	-	21000 J	60000 J	NA	NA	NA	NA
Pyrene	NA	NA	8000 J	-	52000 J	120000 J	NA	NA	NA	NA
<b>METALS</b>	(ug/l)	(ug/kg)	(mg/kg)				(mg/l)			
Aluminum	-	24	8600	44000	3700	3400	NA	NA	NA	NA
Arsenic (5) +	NA	-	6	-	28	19	NA	NA	NA	NA
Cadmium	NA	-	0.6	-	1	1.2	NA	NA	NA	NA
Chromium (5) +	NA	-	740	33	7.8	45	-	NA	NA	NA
Iron	0.18	68	97000	6500	16000	21000	NA	NA	NA	NA
Lead (5) +	NA	13	93	8.4	89	130	NA	NA	NA	.16
Selenium	NA	NA	-	4	2.7	3.5	NA	NA	NA	NA
Zinc	0.28	54	190	20	43	170	NA	NA	NA	NA
<b>TPH</b>	(ug/l)	(ug/kg)	(mg/kg)				(mg/l)			
	42000	NA	41000	19000	38000	19000	NA	NA	NA	NA

#### 4.2.7 SWMU 12 - Pipe Mill Oil Separator

##### 4.2.7.1 Constituent Sampling Results

One water and one oil sample were collected from within the Pipe Mill Oil Separator tank located adjacent to the south side of the Expanded Pipe Shop (Figures 1 and 8). The oil sample was a composite from two locations within the upper 6 inches of the tank. One composit water sample and one grab water sample were collected from under the oil layer for analysis.

Constituent sampling results for the water sample and the oil sample are shown in Table 4-10.

No targeted VOCs or PAHs were detected in the water. No dissolved metals were detected in the water at levels above the NPDWS.

#### 4.2.7.2 Soil Investigation Results

Because PCOCs were detected in the oil sample, a soil investigation was conducted as proposed in the RFI Work Plan. A test pit was excavated approximately 5 feet south of the oil separator tank in an area of surface staining, at the location shown on Figure 8.

Soil in this test pit consisted of silt, sand, and gravel in the upper 1-foot interval, with sand and silt in the remainder of the pit. Staining and a hydrocarbon odor were noted in the upper 1 foot. Staining increased in the lower 1-foot interval. No water was encountered during excavation of the test pit.

Analytical results for soil samples from the test pit at 6-, 12-, 18-, and 24-inches are shown on Table 4-10. It is important to note that although non-detects are reported for PAH compounds in soil data from this SWMU, the detection limits are as high as 27 mg/kg and it was not possible to determine surrogate recoveries. The high detection limits and surrogate failure are attributed to interferences associated with high TPH content in the soils.

Because chromium and lead were reported at potentially hazardous concentrations in the soil samples, the samples were analyzed for these constituents by EP Toxicity Concentrations of chromium in the EP leachates were below regulatory levels.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. Please refer to the risk analysis report submitted with this report for further information.

**Table 4-11**  
**SWMU 13**  
**PIPE MILL EXPANDER PIT**

PARAMETERS	WATER	SEDIMENT	EP TOXICITY SEDIMENT
SAMPLE DEPTH			
VOLATILE ORGANICS	(ug/l)	(ug/kg)	(mg/l)
Benzene	-	-	NA
Chlorobenzene	NA	NA	NA
Ethylbenzene	NA	-	NA
Styrene	NA	-	NA
Toluene	-	3 J	NA
Xylene	NA	9	NA
PAH	(ug/l)	(ug/kg)	(mg/l)
Acenaphthene	NA	-	NA
Acenaphthylene	NA	NA	NA
Anthracene	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA
Chrysene	NA	-	NA
Dibenz(a,h)anthracene	NA	NA	NA
Fluoranthene	NA	-	NA
Fluorene	NA	-	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA
2-Methylnaphthalene	NA	-	NA
Naphthalene	-	-	NA
Phenanthrene	NA	-	NA
Pyrene	NA	-	NA
METALS	(ug/l)	(ug/kg)	(mg/l)
Aluminum	-	3100	NA
Arsenic (5) +	NA	1.8	NA
Cadmium	NA	-	NA
Chromium (5) +	NA	240	-
Iron	0.26	450000	NA
Lead (5) +	NA	32	NA
Selenium	NA	NA	NA
Zinc	0.04 B	-	NA
TPH	(ug/l)	(ug/kg)	(mg/l)
	5.8	33000	NA

#### 4.2.8 SWMU 13 - Pipe Mill Expander Pit

##### 4.2.8.1 Constituent Sampling Results

###### 4.2.8.1.1 Sampling Locations

One water and one sediment sample were collected from within the Pipe Mill Expander Pit in the Expander Pipe Shop Building (Figures 1 and 8).

###### 4.2.8.1.2 Wastewater Results

Constituent sampling results for SWMU 13 are shown in Table 4-11. The water was oily, odoriferous and brown in color.

No targeted dissolved metals were detected in the water at concentrations above the NPDWS. Analyzed VOCs were not detected above the detection limit of 12 ug/l. No targeted PAHs were detected in the water.

###### 4.2.8.1.3 Sediment Results

Constituent sampling results for sediment are shown in Table 4-11.

Based on results of total metals analysis, the constituent sediment sample was analyzed for chromium by EP Toxicity methods. The concentration of chromium was below the regulatory level.

###### 4.2.8.2 Soil Investigation Results

No soil investigation was required at SWMU 13 under the RFI Work Plan.

#### 4.2.9 SWMU 14 - Small Rolling Mill Scale Pit (28-inch Mill)

##### 4.2.9.1 Constituent Sampling Results

###### 4.2.9.1.1 Sampling Locations

One round of water and sediment sampling was conducted at SWMU 14, located in a concrete pit in the western end of the Rail Mill Building, as shown in Figure 1.

Table 4-12  
SWMU 14  
SMALL ROLLING MILL SCALE PITS (28 INCH)

PARAMETERS	WATER	SEDIMENT	EP TOXICITY SEDIMENT
VOLATILE ORGANICS	(ug/l)	(ug/kg)	(mg/l)
Benzene	-	43	NA
Chlorobenzene	NA	NA	NA
Ethylbenzene	NA	68	NA
Styrene	NA	120	NA
Toluene	-	140	NA
Xylene	NA	130	NA
PAH	(ug/l)	(ug/kg)	(mg/l)
Acenaphthene	NA	-	NA
Acenaphthylene	NA	NA	NA
Anthracene	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA
Chrysene	NA	-	NA
Dibenz(a,h)anthracene	NA	NA	NA
Fluoranthene	NA	-	NA
Fluorene	NA	-	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA
2-Methylnaphthalene	NA	400 J	NA
Napthalene	-	800 J	NA
Phenanthrene	NA	600 J	NA
Pyrene	NA	-	NA
METALS	(ug/l)	(ug/kg)	(mg/l)
Aluminum	-	17	NA
Arsenic (5) +	NA	63	NA
Cadmium	NA	-	NA
Chromium (5) +	NA	590	-
Iron	0.88	510000	NA
Lead (5) +	NA	57	NA
Selenium	NA	NA	NA
Zinc	0.08 B	49	NA
TPH	(ug/l)	(ug/kg)	(mg/l)
	3.7	14000	NA



#### 4.2.9.1.2 Wastewater Results

Constituent sampling results for wastewater from SWMU 14 are shown in Table 4-12. The water was dark gray to black in color, and odoriferous.

No targeted VOCs or PAHs were detected in the water. No targeted dissolved metals were detected in the water at concentrations above the NPDWS. Iron was detected in the wastewater sample at 0.88 mg/l, above the NSDWS of 0.3 mg/l. This low level of iron should not pose a health risk because the water is enclosed within the scale pit and flows directly into the SWMU 1, 2, 3 Wastewater Settling Basins for additional treatment, without worker intervention.

#### 4.2.9.1.3 Sediment Results

Constituent sampling results for sediment from SWMU 14 are shown in Table 4-12. The sediment was a fine-grained, metallic scale with an oily texture.

Based on the results of the total metals analysis on Table 4-12, the constituent sediment sample was analyzed for chromium by the EP Toxicity method. As shown in Table 4-12, concentrations of chromium were below the regulatory level.

#### 4.2.9.2 Soil Investigation Results

No soil investigation was required at SWMU 14 under the RFI Work Plan.

#### 4.2.10 SWMU 15 - Medium Rolling Mill Scale Pit (35-inch Mill)

##### 4.2.10.1 Constituent Sampling Results

##### 4.2.10.1.1 Sampling Locations

One round of water and sediment sampling was conducted at SWMU 15 located in a concrete pit near the middle of the Rail Mill Building (Figure 1).

##### 4.2.10.1.2 Wastewater Results

Constituent sampling results for wastewater from SWMU 15 are shown in Table 4-13. The water was black in color, odoriferous and had an oil sheen.

No targeted dissolved metals were detected in the water at concentrations above the NPDWS or NSDWS. No targeted VOCs were detected in the water. No drinking water standard is available for naphthalene, detected in the water sample at 300 ug/l. Because the scale pit is enclosed and covered by steel plates,

Table 4-13  
SWMU 15  
MEDIUM ROLLING MILL SCALE PITS

PARAMETERS	WATER	SEDIMENT	EP TOXICITY SEDIMENT
VOLATILE ORGANICS	(ug/l)	(ug/kg)	(mg/l)
Benzene	-	-	NA
Chlorobenzene	NA	NA	NA
Ethylbenzene	NA	-	NA
Styrene	NA	-	NA
Toluene	-	3	NA
Xylene	NA	6	NA
PAH	(ug/l)	(ug/kg)	(mg/l)
Acenaphthene	NA	-	NA
Acenaphthylene	NA	NA	NA
Anthracene	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA
Chrysene	NA	-	NA
Dibenz(a,h)anthracene	NA	NA	NA
Fluoranthene	NA	-	NA
Fluorene	NA	-	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA
2-Methylnaphthalene	NA	90 J	NA
Naphthalene	300 J	100 J	NA
Phenanthrene	NA	70 J	NA
Pyrene	NA	30 J	NA
METALS	(ug/l)	(ug/kg)	(mg/l)
Aluminum	-	31 J	NA
Arsenic (S) *	NA	28 J	NA
Cadmium	NA	-	NA
Chromium (S) *	NA	600	-
Iron	0.25 B	310000	NA
Lead (S) *	NA	0.61 J	NA
Selenium	NA	NA	NA
Zinc	0.08 B	29 J	NA
TPH	(ug/l)	(ug/kg)	(mg/l)
	7600	1400	NA

and because the water flows underground directly into the Wastewater Settling Basins (SWMUs 1, 2, 3) without worker exposure, the naphthalene concentration should not pose a health risk. In addition, naphthalene was not detected in the wastewaters of SWMU 1, 2, 3 nor in wastewater from SWMU 14 or 16.

#### 4.2.10.1.3 Sediment Results

Constituent sampling results for SWMU 15 are shown in Table 4-13. The sediment was medium-grained, metallic scale with an oily texture.

Based on the results of total metal analyses, the constituent sediment sample was analyzed for chromium by EP Toxicity methods. The concentration of chromium was below the regulatory level.

#### 4.2.10.2 Soil Investigation Results

No soil investigation was required at SWMU 15 under the RFI Work Plan.

#### 4.2.11 SWMU 16 - Large Rolling Mill Scale Pit (44-inch Mill)

##### 4.2.11.1 Constituent Sampling Results

##### 4.2.11.1.1 Sampling Locations

One round of water and sediment sampling was conducted at SWMU 16, located in a concrete pit at the eastern end of the Rail Mill Building (Figure 1).

##### 4.2.11.1.2 Wastewater Results

Constituent sampling results for wastewater from SWMU 16 are shown in Table 4-14. The water was black, oily, and odoriferous.

**Table 4-14  
SWMU 16  
HEAVY ROLLING MILL SCALE PITS**

PARAMETERS	WATER	SEDIMENT	EP TOXICITY SEDIMENT
<b>VOLATILE ORGANICS</b>	(ug/l)	(ug/kg)	(mg/l)
Benzene	-	6	NA
Chlorobenzene	NA	NA	NA
Ethylbenzene	NA	4	NA
Styrene	NA	-	NA
Toluene	3	8	NA
Xylene	NA	20	NA
<b>PAH</b>	(ug/l)	(ug/kg)	(mg/l)
Acenaphthene	NA	-	NA
Acenaphthylene	NA	NA	NA
Anthracene	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA
Chrysene	NA	-	NA
Dibenz(a,h)anthracene	NA	NA	NA
Fluoranthene	NA	-	NA
Fluorene	NA	-	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA
2-Methylnaphthalene	NA	-	NA
Napthalene	-	0.09	NA
Phenanthrene	NA	-	NA
Pyrene	NA	-	NA
<b>METALS</b>	(ug/l)	(ug/kg)	(mg/l)
Aluminum	-	53	NA
Arsenic (5) *	NA	203 J	NA
Cadmium	NA	3.4	NA
Chromium (5) *	NA	850	-
Iron	0.18 B	460000	NA
Lead (5) *	NA	1.1 J	NA
Selenium	NA	NA	NA
Zinc	8.5	43	NA
<b>TPH</b>	(ug/l)	(ug/kg)	(mg/l)
	120	2400	NA

No targeted VOCs or dissolved metals were detected in the water at concentrations above the NPDWS. No targeted PAHs were detected in the water. Zinc was detected in the wastewater sample at 8.5 mg/l, above the NPDWS of 5 mg/l. This low level of zinc should not pose a health risk because the water is enclosed within the scale pit and flows directly into the Wastewater Settling Basins (SWMUs 1, 2, 3) for additional treatment.

#### 4.2.11.1.3 Sediment Results

Constituent sampling results for sediment from SWMU 16 are shown in Table 4-14. The sediment was coarse-grained and contained fragments of scale with an oily texture.

Based on the results of total metal analyses, the constituent sediment sample was analyzed for arsenic and chromium by EP Toxicity methods. Concentration of arsenic and chromium were below the regulatory levels.

#### 4.2.11.2 Soil Investigation Results

No soil investigation was required at SWMU 16 under the RFI Work Plan.

#### 4.2.12 SWMU 20 - HWM3 Pelletizer

##### 4.2.12.1 Constituent Sampling Results

No constituent sampling at SWMU 20 was required under the RFI Work Plan.

##### 4.2.12.2 Soil Investigation Results

The HWM3 Pelletizer is located immediately west of the Steelmaking Building, as shown in Figure 1. The pelletizer is located on an asphalt pad surrounded by an 8-inch curb. The pad slopes toward the center, and runoff

Table 4-15  
SWMU 20  
HWM3 PELLETERIZER

SAMPLE DEPTH	TEST PIT A				TEST PIT B				TEST PIT C			
	6"	12"	18"	24"	6"	12"	18"	24"	6"	12"	18"	24"
METALS	(mg/kg)											
Cadmium	28	-	23	18	-	-	0.9	-	3.6	-	-	-
Chromium	130	5	120	98	4	41	110	40	45	41	18	17
Lead	2100	37	180	1600	10	48	92	30	380	49	36	35
Zinc	7400	150	6700	5200	45	480	1200	290	910	120	99	100

is collected in an underground tank (SWMU 21 - Pelletizer Runoff Tank). To evaluate whether a release of PCOCs had occurred, three test pits were excavated at the locations shown on Figure 9. One test pit was located near the underground tank and two test pits were located outside the bermed area at the western and southern edges of the pad (Figure 9). The character of the soil under the asphalt was variable at the three test pits, but consisted predominantly of sand and silt with areas of fill material (see Appendix E for boring logs). No water was encountered during excavation of the test pits.

Analytical results for soil samples collected from test pits 20A, 20B, and 20C are shown in Table 4-15. EP Toxicity analysis of soil samples was not required by the RFI Work Plan at this SWMU.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

#### 4.2.13 SWMU 22 - No. 2 Pelletizer

##### 4.2.13.1 Constituent Sampling Results

No constituent sampling at SWMU 22 was required under the Work Plan.

##### 4.2.13.2 Soil Investigation Results

The No. 2 Pelletizer baghouse is an enclosed metal building on a concrete pad located adjacent to and south of the Heat Treating Building (Figure 1). To evaluate whether a release of PCOCs had occurred, two test pits were excavated along the west edge of the building, where loading activities are conducted. One test pit was located at each corner of the building, as shown on Figure 10. The area in front of the pelletizer, where the test pits were excavated, is covered by a layer of asphalt. Soil in both test pits consisted of fill material containing pebbles and sand, with some silt and clay. No water was encountered during excavation of the test pits.

**Table 4-16**  
**SWMU 22**  
**NO. 2 PELLETIZER**

	TEST PIT A				TEST PIT B			
SAMPLE DEPTH	6"	12"	18"	24"	6"	12"	18"	24"
METALS	(mg/kg)							
Cadmium	2.6	0.9	0.6	2	1.6	2	1.7	0.7
Chromium	10	5	4	51	13	79	110	330
Lead	220	93 J	49	190	92	180	250	200
Zinc	730	260 J	180	470	260	470	550	470

Analytical results for soil samples collected from the test pits at 6-, 12-, 18-, and 24-inch depths are shown in Table 4-16. EP Toxicity analyses of soil samples were not required by the RFI Work Plan at this SWMU.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

#### 4.2.14 SWMU 24 - EAF Spray Chambers Drop Legs

##### 4.2.14.1 Constituent Sampling Results

No constituent sampling was required at SWMU 24 under the RFI Work Plan.

**Table 4-17**  
**SWMU 24**  
**EAF SPRAY CHAMBERS DROP LEGS**

	TEST PIT A				TEST PIT B				TEST PIT C			
SAMPLE DEPTH	6"	12"	18"	24"	6"	12"	18"	24"	6"	12"	18"	24"
METALS	(mg/kg)											
Cadmium	190	160	100	57	130	17	12	13	93	95	75	130
Chromium	500	680	740	440	630	240	380	670	780 J	860	790	720
Lead	16000	14000	9300	3600	9300	1300	690	860	3900 J	7600	4100	10000
Zinc	120000	90000	48000	27000	68000	7100	3000	3800	40000 J	40000 J	47000	70000

#### 4.2.14.2 Soil Investigation Results

The EAF Spray Chambers Drop Legs are located inside the Steelmaking Building, as shown in Figure 1. One test pit was excavated adjacent to each of the three concrete pads that collect particulate matter from the EAF spray chambers (Figure 11). The soil at each location consisted of fill material containing slag, with some sand and silt. The slag was very hard and occurred as gravel or large pieces. Test pit logs are presented in Appendix E. No water was encountered in any of the test pits.

Analytical results for soil samples collected from the three test pits (24A, 24B, and 24C) are shown in Table 4-17. No EP Toxicity analyses for metals were required in the RFI Work Plan.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

#### 4.2.15 SWMU 25 - Steel Foundry Electric Furnace (SFEF) Baghouse Bin

##### 4.2.15.1 Constituent Sampling Results

One dust sample was collected from SWMU 25 in a baghouse bin southwest of the steel foundry (Figure 1). The dust was very fine-grained and reddish-brown in color.

Constituent sampling results for SWMU 25 are shown in Table 4-18. EP Toxicity analysis of the sample was not required under the RFI Work Plan.

Table 4-18  
SWMU 25  
SFEF BAGHOUSE BIN

PARAMETERS	DUST	SOIL INVESTIGATION			
SAMPLE DEPTH		6"	12"	18"	24"
METALS	(ug/kg)	(mg/kg)			
Cadmium	15	2.6	-	-	-
Chromium	2400	15	37	40	36
Lead	1200	90	21	9	11
Zinc	2200	680	190	32	12

Because PCOCs were detected in the dust, a soil investigation was conducted as proposed in the RFI Work Plan.

##### 4.2.15.2 Soil Investigation Results

To evaluate whether there have been releases of PCOCs from SFEF dust, a test pit was excavated next to the concrete pad immediately south of the baghouse in an area where dust was visible on the surface (Figure 12). Soil

consists of fill material containing sand, silt, slag, and gravel. No water was encountered during excavation of the test pit.

Analytical results for soil samples from the test pit at 6-, 12-, 18-, and 24-inch depths are shown in Table 4-18. No EP Toxicity analysis of soil samples was required by the RFI Work Plan at this SWMU.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for further information.

#### 4.2.16 SWMU 29 - Frog and Switch Grinder Cyclone Holding Room

##### 4.2.16.1 Constituent Sampling Results

The Frog and Switch Building is located approximately 1,500 feet northwest of the Expander Pipe Shop, as shown on Figure 1. A sample could not be obtained from the bin in the cyclone holding room because the dust collection ductwork had been under repair. Therefore, the sample was collected at the fan intake, adjacent to the Grinder Cyclone inside the Frog and Switch Building (Figure 13). The powder was very fine-grained, gray in color, and metallic.

Constituent sampling results for SWMU 29 are shown in Table 4-19.

Table 4-19  
SWMU 29  
FROG AND SWITCH GRINDER CYCLONE  
HOLDING ROOM

PARAMETERS	SEDIMENT	EP TOXICITY SEDIMENT
SAMPLE DEPTH		
METALS	(ug/kg)	(mg/l)
Aluminum	3200	NA
Arsenic (5) +	10	NA
Cadmium	-	NA
Chromium (5) +	930	.07
Iron	NA	NA
Lead (5) +	8	NA
Selenium	NA	NA
Zinc	18	NA
TPH	(ug/kg)	(mg/l)
	NA	NA
PHENOLS	(mg/kg)	(mg/l)
	9.3	NA

PARAMETERS	SOIL INVESTIGATION								EP TOXICITY SOIL							
	TEST PIT A				TEST PIT B				TEST PIT A				TEST PIT B			
SAMPLE DEPTH	6"	12"	18"	24"	6"	12"	18"	24"	6"	12"	18"	24"	6"	12"	18"	24"
METALS	(mg/kg)								(mg/l)							
Aluminum	2000	6400	4700	8300	2100 J	4800	3000	6800	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic (5) +	24	97	130	120	55	91	56	13	NA	NA	-	.01	NA	NA	NA	NA
Cadmium	-	6.2	5.6	6	1.2 J	1.9	1.1	0.6	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (5) +	420	83	71	39	590 J	20	18	16	-	NA	NA	NA	.02	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead (5) +	95	280	240	140	220	340	120	52	NA	.02	-	.02	.008	.03	-	NA
Selenium	-	-	-	-	UJ	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	78	180	170	180	170 J	70	51	140	NA	NA	NA	NA	NA	NA	NA	NA
TPH	(mg/kg)								(mg/l)							
	1	-	0.6	-	1.5	0.4	-	-	NA	NA	NA	NA	NA	NA	NA	NA

Based on the results of total metal analyses, the constituent dust sample was analyzed for chromium by the EP Toxicity method. The concentration of chromium in the EP leachate was below the regulatory level.

#### 4.2.16.2 Soil Investigation Results

Because PCOCs were detected in the dust, a soil investigation was conducted as proposed in the RFI Work Plan. To determine whether a release of constituents had occurred, two test pits were excavated in front of the Grinder Cyclone Holding Room shed adjacent to the east side of the Frog and Switch building. The test pits were excavated near each corner of the shed in an area of red and brown surface dust at the locations shown in Figure 13. Soil consists of fill material containing slag fragments with some sand.

Analytical results for soil samples collected from test pits 29A and 29B are shown in Table 4-19. Based on the results of total metal analyses, the 6-inch soil sample from 29A was analyzed for chromium, the 12-inch sample for lead, and the 18- and 24-inch samples for arsenic and lead by EP Toxicity procedures. The 6-inch soil sample from 29B was analyzed for chromium and lead and the 12- and 18-inch samples were analyzed for lead by EP Toxicity procedures. As shown in Table 4-19, concentrations were below the regulatory level.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

#### 4.2.17 SWMU 31 and 32 - Caustic Waste Rinsewater Tanks

##### 4.2.17.1 Constituent Sampling Results

One composite water sample was collected at SWMU 31 and 32, located south of the Electrical Building (Figure 1). The water sample was collected below a 1/2-inch oil layer in each tank and composited. The pH of the composited water sample was 12.0 at a temperature of 13.6°C.

Constituent sampling results for the water sample from SWMU 31 and 32 are shown in Table 4-20.

No targeted dissolved metals except for chromium and lead were detected at concentrations above the NPDWS or NSDWS. Chromium and lead were detected in the rinsewater at 0.24 mg/l, and 0.4 mg/l, respectively. These concentrations are greater than the NPDWS for chromium (0.05 mg/l) and lead (0.05 mg/l). The metals should not pose a health risk because the water is contained within enclosed steel storage tanks that are pumped out periodically by suction trucks and deposited into the Wastewater Settling Basins (SWMUs 1, 2, and 3) for further treatment without worker exposure to the water. Chromium and lead were not detected in the wastewaters of SWMUs 1, 2, and 3.

Table 4-20  
SWMUs 31 & 32  
CAUSTIC WASTE RINSEWATER TANKS

PARAMETERS	WATER	SOIL INVESTIGATION			
SAMPLE DEPTH		6"	12"	18"	24"
METALS	(ug/l)	(mg/kg)			
Aluminum	1.3	3100	7100	5000	6200 J
Arsenic	0.03	26	7.1	8.4	7.3
Cadmium	-	400	16	1.2	7.4
Chromium	0.24	~500	47	14	27 J
Lead	.40	28000	1000	4800	570 J
Selenium	NA	1.9	-	-	-
Zinc	0.17	140000	3400	400	1800 J
TPH	(ug/l)	(mg/kg)			
	16	190	420	43	73
pH					
	NA	9	8	7	8

Because PCOCs were detected in the water above NPDWS and NSDWS, a soil investigation was conducted as proposed in the RFI Work Plan.

#### 4.2.17.2 Soil Investigation Results

As shown in Figure 14, a test pit was excavated in an area of surface staining 3 feet south of the tank and just outside the bermed area. Soil consisted of silt and clay in the upper 1-foot interval, and sand and silt in the lower 1-foot interval of the test pit. No water was encountered during excavation of the test pit.

Analytical results for soil samples collected from the test pits are shown in Table 4-20. EP Toxicity analysis of soil samples was not required by the RFI Work Plan.

Concentrations of PCOCs in the soil have been evaluated with respect to action levels developed by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for further information.

#### 4.2.18 SWMU 34 - Plant Canal

##### 4.2.18.1 Sampling Locations

One sediment sample and one composite water sample during average flow condition were collected at 10 locations approximately 1,500 feet apart along the plant canal. An additional grab water sample was collected at each location immediately following a storm event. The sampling locations are shown in Figure 3.

##### 4.2.18.2 Water Results During Normal Flow Conditions

During average flow conditions, three rounds of water samples at each location were collected approximately three hours apart and composited (Table 4-21). The water was clear to slightly cloudy. Analytical results for composited surface water samples are presented in Table 4-22.

No PAHs or VOCs were detected in the canal water during the average flow event. Dissolved metals, if detected, were measured at concentrations below the NPDWS and NSDWS.

##### 4.2.18.3 Water Results During Storm Flow Conditions

One sample from each monitoring location was collected on April 30, 1990, after a total of 1.33 inches of rain had fallen the previous day. As agreed upon by the USEPA, storm-flow canal surface water samples were not composited due to difficulty in traversing the canal by boat during storm runoff. Analytical results for storm-flow surface water samples are presented in Table 4-23.

Table 4-21  
NORMAL FLOW WATER SAMPLING OF  
PLANT CANAL

SAMPLING TIME			
SAMPLING LOCATION	ROUND 1	ROUND 2	ROUND 3
C1	9:05	11:50	3:00
C2	9:25	12:05	3:12
C3	9:45	12:15	3:25
C4	10:03	12:25	3:37
C5	10:20	12:43	3:47
C6	10:32	12:50	3:58
C7	8:13	11:05	2:00
C8	8:35	11:25	2:15
C9	8:50	11:45	2:25
C10	9:05	11:50	2:35
C11	9:10	11:50	2:35

- Notes:
1. C1 is a composite of samples taken during Rounds 1, 2, and 3.
  2. C11 is a duplicate of C10.
  3. C1 through C6 were sampled on April 23, 1990.
  4. C7 through C11 were sampled on April 24, 1990.



**Table 4-22**  
**LABORATORY RESULTS FOR SURFACE WATER FROM**  
**CANAL APRIL 24, 1990**

CANAL SAMPLING POINT	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
<b>VOLATILE ORGANICS</b>	(ug/l)									
	-	-	-	-	-	-	-	-	-	-
<b>PAH</b>	(ug/l)									
	-	-	-	-	-	-	-	-	-	-
<b>METALS</b>	(mg/l)									
Iron	0.05	0.06	0.05	0.05	0.05	0.05	0.09	0.13	0.23	0.12
Zinc	-	-	-	-	-	-	0.01	0.02	0.04	0.01
<b>TPH</b>	(mg/l)									
	-	-	-	-	-	-	-	0.9	4.1	1.6

**Table 4-23**  
**LABORATORY RESULTS FOR STORM WATER SAMPLES FROM**  
**CANAL MARCH 30, 1990**

CANAL SAMPLING POINT	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
<b>VOLATILE ORGANICS</b>	(ug/l)									
	-	-	-	-	-	-	-	-	-	-
<b>PAH</b>	(ug/l)									
	-	-	-	-	-	-	-	-	-	-
<b>METALS</b>	(mg/l)									
Iron	-	.09 U*	.08 U*	-	-	-	-	-	.12 U*	.07 U*
Lead	-	-	-	-	-	.01	-	-	-	-
Zinc	-	.04 U*	.02 U*	.01 U*	.03 U*	.03 U*	.05 U*	.03 U*	.02 U*	.02 U*
<b>TPH</b>	(mg/l)									
	12	-	2	-	-	-	1.7	2.5	3.9	2.7

NOTES: U\* = Method blank data indicate that this value is a laboratory artifact

No PAHs or VOCs were detected in the canal water during the storm flow sampling event. Dissolved metals, if detected, were measured at concentrations below the NPDWS and NSDWS. Iron and zinc detected at low concentrations were interpreted as laboratory artifacts as discussed in the Round 4 data validation report.

#### 4.2.18.4 Sediment Results

Sampling results for sediment samples collected from the canal are shown in Table 4-24. The sediment collected with the ponar dredge at all sampling locations consisted of an upper 1/2 inch of brown soil with an

underlying mixture of black silt and clay. A hydrocarbon odor was noted in sediment samples from locations C-10, C-6, and C-9.

Concentrations of PCOCs in the sediment have been evaluated with respect to action levels by Dames & Moore. See "Risk Assessment, RCRA Facility Investigation, Bethlehem Steel Corporation's Steelton, Pennsylvania Facility, September 1991." (Volume 3) for additional information.

Table 4-24  
LABORATORY RESULTS FOR SEDIMENT SAMPLES FROM CANAL

CANAL SAMPLING POINT	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11 '
<b>VOLATILE ORGANICS</b>	(ug/kg)										
Xylene	-	-	-	-	-	-	3 J	-	-	-	-
<b>PAH</b>	(ug/l)										
Acenaphthene	-	-	-	-	-	-	-	70 J	-	-	-
Anthracene	-	-	-	-	-	-	-	97 J	-	33 J	-
Benzo(a)pyrene	47 J	-	-	-	-	-	-	150 J	67 J	110 J	-
Benzo(a)anthracene	-	-	-	-	-	-	-	250 J	93 J	210 J	93 J
Benzo(b)fluoranthene	-	-	-	-	-	-	-	93 J	47 J	110 J	50 J
Benzo(k)fluoranthene	-	-	-	-	-	-	-	100 J	50 J	140 J	50 J
Chrysene	80 J	-	37 J	-	-	-	-	270 J	110 J	300 J	120 J
Fluoranthene	110 J	47 J	57 J	-	-	-	47 J	500	120 J	380	120 J
Fluorene	-	-	-	-	-	-	-	77 J	-	-	-
2-Methylnaphthalene	-	-	-	-	-	-	-	160 J	47 J	-	-
Naphthalene	-	120 J	110 J	-	63 J	90 J	60 J	520	180 J	80 J	73 J
Phenanthrene	67 J	-	-	-	-	-	-	430	73 J	170 J	90 J
Pyrene	120 J	60 J	53 J	-	-	-	67 J	490	150 J	330 J	350 J
<b>METALS</b>	(mg/l)										
Aluminum	3800	5000	4500	5000	4000	6200	4400	7800	5200	3100	4400
Arsenic	2.2	3.1	2.6	2.5	3.3	3.7	2.4	7.6	6.8	4.7	5.1
Cadmium	-	0.8	0.6	1	0.5	1.2	1	2.6	1.4	0.6	0.9
Chromium	6.9	14	9.5	13	12	18	14	37	40	28	31
Iron	9400	15000	10000	12000	8900	15000	11000	49000	42000	25000	30000
Lead	19	57	32	46	25	52	36	160	120	73	78
Zinc	120	190	160	220	160	270	190	890	370	180	220
<b>TPH</b>	(mg/l)										
	160 J	460 J	150 J	520 J	220 J	790 J	540 J	410 J	1900 J	3000 J	4700 J

## 5.0 GROUNDWATER INVESTIGATION

### 5.1 DISPOSAL HISTORY AND PREVIOUS INVESTIGATIONS

The HWM-1 Landfill is located north of Front Street and is separate from the Steelton production facilities, as shown on Figure 1. The closed HWM-1 Landfill now covers approximately 7.5 acres and is located within the Residual Waste Landfill (SWMU 30), as shown on Figure 1. The HWM-1 Landfill contains approximately 300,000 cubic yards of electric arc furnace (EAF) dust. EAF dust is the only waste disposed of at the HWM-1 Landfill. A description of EAF dust is included in Attachment A of the approved RFI Work Plan (Volume 1). Land disposal of EAF dust at HWM-1 began in 1976. Effective November 19, 1980, EAF dust was listed as a hazardous waste (K061) due to its lead, cadmium, and chromium components. Effective November 19, 1980, the HWM-1 disposal area was regarded as having interim status and was designated as Hazardous Waste Management Facility No. 1. Since January 1, 1986, EAF dust generated at the plant has been shipped off-site for recycling.

Groundwater monitoring of wells MW-5, -6, -7, -8, -9, and -10 at the HWM-1 Landfill began on a quarterly basis in August 1985 as mandated by the PADER. The first year's groundwater data were summarized in a report entitled "Groundwater Quality Assessment and Abatement Program for HWM-1 (GQAAP)," which was prepared by Baker/TSA, Inc. of Corapolis, Pennsylvania, and submitted to the PADER in November 1987. The GQAAP included information on the hydrogeology, geochemistry, and groundwater flow direction in the vicinity of the HWM-1 Landfill. Based on this report, it was concluded that capping of the HWM-1 Landfill with a low-permeability cover was the most appropriate method to protect groundwater quality. The procedures followed in capping of the HWM-1 Landfill are contained in the BSC report entitled "Summary of Closure Aspects of Approved Closure and Post Closure Plan, HWM-1 Landfill" originally prepared in May 1986 and with PADER-approved revisions through January 1989. Capping of the HWM-1 Landfill was completed in December 1989. The cap consisted of a low-permeability soil cover, geomembrane cover, geonet drainage layer, geotextile protective layer, and vegetated soil cover. BSC submitted a post closure permit application in June of 1990. At present, MW-5, -6, -8, and -10 are sampled quarterly with monitoring reports submitted to PADER.

### 5.2 HYDROGEOLOGY

This section contains a discussion of the hydrogeology at the landfill area.

#### 5.2.1 Geology

The Residual Waste Landfill (SWMU 30) and HWM-1 Landfill (SWMU 18) are underlain by two distinct geologic strata: limestones of the Epler Formation of Ordovician age and shales of the Gettysburg Formation of Triassic age. The Gettysburg Formation is found in unconformable contact with the Epler Formation just southeast of the HWM-1 Landfill, as shown on Figure 15. The contact between the two formations is a normal fault that has displaced the two formations, as shown on Figure 16, and exposed the older Epler Formation at the surface. The trace of the fault plane strikes approximately east-west and dips approximately 35 degrees to the south.

The Epler Formation consists of interbedded dark-gray, finely crystalline limestone and massive dark-gray, finely crystalline dolomite. It is described in the PADER report entitled "Environmental Geology of the Greater Harrisburg Metropolitan Area, Environmental Geology Report No. 4" prepared in 1976 (PADER, 1976). This formation has been subjected to tectonic stresses that formed folds, fractured the limestone, and heavily fractured the dolomite. The Hempt Brothers Quarry, northwest of the HWM-1 Landfill, is located in the Epler Formation. The Gettysburg Formation consists of interbedded red fissile shales, siltstones, and fine- to coarse-grained sandstone (PADER, 1976).

Depth to bedrock beneath the HWM-1 Landfill area ranges from 6 to 40.5 feet (GQAPP, 1987). The material above the bedrock consists of slag, or soil of the Hagerstown-Duffield Association. This soil has developed from the weathering of limestone and dolomite, and has moderate permeability.

### 5.2.2 Aquifer Characteristics

#### 5.2.2.1 Epler Formation

Ground water in the Epler Formation flows mainly through joints and fractures in the finely crystalline limestone rather than through primary intergranular voids (porosity). Monitoring wells MW-5, -6, -7, -8, -9, and -10 near the HWM-1 Landfill and background well MW-1 are screened within and produce water from the Epler Formation. Boring logs and well construction diagrams are included in Appendix G.

By means of pumping tests in MW-5 through MW-10 (GQAPP, 1987), hydraulic conductivities in the Epler Formation have been calculated to range from 4 to 713 feet per day. Using these estimated hydraulic conductivities, the groundwater velocity in this formation has been estimated at 2.6 to 428 feet per day, assuming a hydraulic gradient of 0.06 and an effective porosity of 0.10 (GQAPP, 1987). The variability in hydraulic conductivity values is due to the variable frequency and distribution of fractures in the limestone aquifer. A higher hydraulic conductivity will typically be measured for a well that intersects a high density and extensive distribution of fractures as compared to a well that intersects an area with infrequent fractures.

The depth to water in wells screened in the Epler Formation around the perimeter of the HWM-1 Landfill ranged from approximately 30 to 60 feet below the land surface. The shallow aquifer in the vicinity of HWM-1 is, in general, an unconfined system. Ground water within the Epler Formation also occurs locally under semi-confined conditions, as evidenced by an increase in water levels in the boreholes for MW-11 and MW-12 while certain intervals in the aquifer were being drilled by Baker/TSA (letter report to BSC, April 1990).

#### 5.2.2.2 Gettysburg Formation

Ground water in the Gettysburg Formation flows preferentially through discontinuities along bedding planes, fractures, and joints in the bedrock. Monitoring wells MW-2, -3, and -4 are screened within and produce water from the Gettysburg Formation. Boring logs and well construction diagrams are included in Appendix G.

The hydraulic conductivity in the Gettysburg Formation has been calculated at 0.10 foot per day, as determined from a slug test in MW-2 (GQAPP, 1987). Using this estimated hydraulic conductivity, the groundwater velocity has been estimated at 0.12 foot per day, assuming a hydraulic gradient of 0.06 and an effective porosity of 0.05. The Gettysburg Formation is classified as a good aquifer, with an average yield of 315 gallons per minute for 17 wells in the nearby Middletown area (PADER, 1976).

During purging at a rate of 12 gallons per minute, wells 2 and 4 became dry. Although this yield is less than the average yield for the 17 wells in the Middletown area, the yield of a particular well would be expected to vary depending on the frequency and distribution of fractures intersected, and the well construction (length of screened interval, well diameter, etc.).

### 5.2.3 Groundwater Flow Directions

#### 5.2.3.1 Groundwater Flow in Landfills

A groundwater flow map, derived from water level data collected on October 16, 1990, is shown on Figure 17. In addition to MW-1, -2, -3, and -4 (Residual Waste Landfill) monitoring wells and MW-5, -6, -7, -8, -9, and -

10 (HWM-1 Landfill) monitoring wells, water level measurements were also taken in wells MW-11, -12, -13, -14, and -15, wells that are monitored at the request of PADER. Water level data is presented in Table 5-1. A summary of well construction data is given in Table 5-2. The groundwater levels are measured for wells screened in different depth intervals of the Epler Formation aquifer and in the Gettysburg Formation aquifer. Because the direction of groundwater flow through both formations is probably heavily influenced by fracture orientation, the

**Table 5-1**  
**GROUND WATER ELEVATIONS FOR MONITORING WELLS AND PIEZOMETERS**  
**AT THE HWM-1 AND RESIDUAL LANDFILLS**  
**OCTOBER 16, 1990**

WELL	DEPTH TO WATER FROM TOOC(Ft) <sup>1</sup>	ELEVATION OF TOOC <sup>2</sup> (Feet above MSL)	GROUND WATER ELEVATION (in Feet above MSL)
1	94.08	416.93	322.85
2	25.28	402.95	377.67
3	95.81	416.75	320.94
4	9.80	336.78	326.98
5	52.48	403.61	351.13
6	38.07	371.58	333.51
7	32.94	385.93	352.99
8	44.60	418.01	373.41
9	56.84	406.87	350.03
10	54.04	401.43	347.39
11	156.50	436.12	279.62
12	153.3	435.44	282.14
13	120.00	445.31	325.31
<b>PIEZOMETERS</b>			
14 S	4.14	329.08	324.94
14 M	2.70	330.91	328.21
14 D	2.57	330.91	328.34
15 S	8.90	338.51	329.61
15 M	5.94	337.45	331.51
15 D	5.10	337.45	332.35

**Notes:** <sup>1</sup> Top Of Outer Casing (TOOC)  
<sup>2</sup> Elevation of TOOC data from Baker/TSA.

groundwater flow patterns indicated on Figure 17 are more generalized than the actual convoluted flow paths within the fractured bedrock aquifers. The heavy fracturing of the limestone and dolomite of the Epler Formation suggests that fractures may be in communication throughout the aquifer and that the water level data collected are representative, in a broad sense, of the general direction of groundwater flow throughout the aquifer.

As shown on Figure 17, ground water in the unconfined flow system beneath the eastern half of the HWM-1 Landfill flows primarily in an east-northeasterly direction, toward Laurel Run. Ground water beneath the western half of the HWM-1 Landfill flows to the north-northwest, toward the active Hempt Brothers Quarry. Quarry

Table 5-2  
MONITORING WELL CONSTRUCTION DATA<sup>1</sup>

Well Number	Elevation Top of Casing (ft above MSL)	Reported Casing Stickup (ft)*	PA State Plane Coordinates		Approximate Elevation to Top of Weathered Bedrock** (ft above MSL)	Screened Interval (ft)*	Sand Pack Interval (ft)*
			North-South	East-West			
MW-1	416.93	3.48	326,083.45	2,264,572.14	378	open hole from 42 to 124	N/A
MW-2	402.95	3.51	323,764.88	2,264,379.60	379	slotted casing 30-60/open hole from 60-100	N/A
MW-3 (located off map boundaries)	416.75	3.53	323,779.23	2,262,565.03	358	open hole from 55 to 160	N/A
MW-4	336.78	3.19	323,747.96	2,265,912.71	311	open hole from 52 to 150	N/A
MW-5	403.61	2.61	324,147.73	2,265,504.63	344	58-78	57-79
MW-6	371.58	2.41	324,420.43	2,265,549.84	343	35-55	34-56
MW-7	385.93	2.87	324,746.72	2,265,338.42	360	100-120	95-120
MW-8	418.01	2.62	324,035.90	2,264,986.73	361	60-80	59-86
MW-9	406.87	2.84	324,896.07	2,265,007.21	394	100-120	49-121
MW-10	401.43	2.72	324,769.00	2,264,706.08	385	103.5-123.5	83-123.5
MW-11	436.12	2.32	324,768.81	2,263,810.72	383	115-199	110-200
MW-12	435.44	2.3	324,643.32	2,263,727.88	374	145-175	137.7-178
MW-13	445.31	2.65	324,410.65	2,263,862.35	unknown (however residual soils encountered near 371 feet)	113.5-143.5	108.2-144
MW-14S	329.08	2.0	-	-	315	5-25	3-25
M	330.91	3.5	-	-	-	517-537	508-538
D	330.91	3.5	-	-	-	577-597	544-597
MW-15S	338.51	2.8	-	-	322.5	5-25	5-25
M	337.45	2.0	-	-	-	82-102	78-102
D	337.45	2.0	-	-	-	180-220	170-220

Notes:

\* Measurements from the ground surface.

\*\* Elevations based on observations made during air rotary drilling. The actual top of weathered bedrock elevation may vary from those reported here.

(1) Well construction data from Baker/TSA report dated May 15, 1990 and entitled "Preliminary Groundwater Monitoring Results for Steelton Plant, March 1989." Well construction data for MW-14 and MW-15 from R.E. Wright Associates report dated January 1991 and entitled "Report on the Groundwater Investigation in the HWM-1 Area at the Bethlehem Steel Corporation, Steelton Plant."

pumping activities have significantly influenced groundwater flow by locally lowering the water table and inducing groundwater flow toward the quarry from a large portion of the Residual Waste Landfill. This has resulted in the development of a groundwater divide oriented northeast-southwest. The quarry pumps ground water from a dewatering pit located along the north wall of the quarry for use in quarry operations. Pumping is also necessary to maintain the water table below the floor of the quarry, because the elevation of the quarry floor is approximately 30 feet below the surface level of the Susquehanna River, as described in a report entitled "Groundwater Investigation in the HWM-1 Area" prepared by R.E. Wright Associates, Inc. of Middletown, Pennsylvania, in January 1991 for BSC (REWAI, 1991). A file search and interviews with quarry personnel conducted by R.E. Wright Associates (1991) suggest that the quarry is pumping approximately 2,000 gallons per minute, 8 hours per day, 5 days per week, 52 weeks per year. Water from quarry operations is discharged through a series of settling ponds and eventually to the Susquehanna River.

Downgradient wells, which have been used to monitor groundwater quality before and after the abatement activity at the capped and closed HWM-1 Landfill, include MW-5, -6, -7, -9, and -10. Presently, the downgradient wells monitored for PADER are MW-5, -6, and -10. As shown on Figure 17, MW-5, -6, and -7 intercept ground water flowing north and northwestward, toward the quarry. MW-8, on the southern perimeter of the HWM-1 Landfill, appears to be an upgradient well very near the crest of the abovementioned groundwater divide. MW-1 is located outside the boundaries of the Residual Waste Landfill on the opposite side of the quarry and is used as a background well. As shown on Figure 17, MW-1 is not a downgradient well, as ground water from beneath the HWM-1 Landfill is diverted toward the quarry. Monitoring wells 2 and 3 are located within the Residual Waste Landfill. MW-2 is upgradient of HWM-1. MW-3 is not a downgradient well as ground water from beneath the HWM-1 Landfill is diverted toward the quarry. MW-4 is downgradient of the HWM-1 Landfill.

#### 5.2.3.2 Influence of Fault on Groundwater Quality and Flow Direction

Surface water sampling locations along Laurel Run were located upstream and downstream from the trace of the fault contact and can be used to assess the influence of the fault as a conduit for groundwater flow. As discussed in Section 5.4.5, no differences in surface water quality were noted between water samples collected upstream and downstream of the fault.

Furthermore, recent observations from piezometers screened at the fault contact between the Epler and Gettysburg Formations as part of a PADER study (REWAI, 1991) suggest that ground water does not preferentially flow along the fault, as suggested in the RFI Work Plan and GQAAP. At the request of the PADER, piezometers 14S, M, and D and 15S, M, and D were installed. Piezometers 14M and 15M were installed to intersect the fault (REWAI, 1991). Piezometer-14M spans the fault contact at a depth of 525 feet, where a low-yielding, water-bearing zone (1 gpm) was encountered (REWAI, 1991). Piezometer-15M is located west of Laurel Run, as shown on Figure 15. Piezometer-15M is screened from 82 to 102 feet to straddle the fault contact at 93 feet (REWAI, 1991). No water-bearing zone was detected at the fault contact in Piezometer-15M. Thus, the fault does not appear to be a conduit for groundwater flow, because little groundwater flow was encountered in wells screening the fault.

#### 5.2.3.3 Laurel Run Stream

As part of the RFI, surface water in Laurel Run was sampled to assess the impact, if any, of groundwater discharge from the HWM-1 and Residual Waste Landfills into the stream. The surface water quality of Laurel Run is of concern, because the stream flows southward and discharges into the Susquehanna River (Figure 15). Laurel Run is shallow (0.33 to 2 feet deep) and typically is 6 to 12 feet wide.

The PADER requested that multilevel piezometers be installed at two locations south of the fault trace to assess whether Laurel Run is a barrier to groundwater migration, and to confirm that it is a discharge point for ground water from the landfill. Piezometers 14S, M, and D were installed east of Laurel Run, as shown on Figure 15. Piezometers 15S, M, and D were installed west of Laurel Run, as shown on Figure 17. Piezometers 14S and 15S

are screened at different depths in the Gettysburg Formation; 14M and 15M screen the fault contact; and 14D and 15D screen the Epler Formation (REWAI, 1991). Static water levels were recorded in these multi-level piezometers by Dames & Moore on October 16, 1990.

Water elevations shown on Table 5-3 reveal an upward vertical gradient at both locations within both the Gettysburg and Epler Formations. The piezometers screened at deeper depth intervals have higher water elevations. Because water generally flows from areas of higher hydraulic head to those of lower head, there is a deduced upward component of groundwater flow at locations 14 and 15. This upward gradient suggests that ground water discharges to Laurel Run from depth. However, the rate of upward movement can only be evaluated by means of pumping tests.

**Table 5-3**  
**WATER ELEVATIONS AT NESTED PIEZOMETERS**

WELL	SCREENED INTERVAL (BLS)	FORMATION SCREENED	WATER ELEVATION (FEET ABOVE MSL)
14 S	5-25'	Gettysburg Formation	324.94
14 M	517-537'	Fault Contact at 525'	328.21
14 D	577-597'	Epler Formation	328.34
15 S	5-25'	Gettysburg Formation	329.61
15 M	82-102'	Fault Contact at 93'	331.51
15 D	180-220'	Epler Formation	332.35

### **5.3 GROUNDWATER AND SURFACE WATER SAMPLING**

This section outlines procedures used to sample the four monitoring wells (MW-1 through MW-4) at the Residual Waste Landfill and the six monitoring wells (MW-5 through MW-10) at the HWM-1 Landfill. Methods used to collect surface water samples from Laurel Run are also discussed. Groundwater and surface water sampling procedures were executed in accordance with the RFI Work Plan and its approved modifications.

Additional quarterly sampling of Laurel Run surface water was implemented in accordance with requirements of Mr. Robert E. Grave's letter (RCRA Enforcement Branch, USEPA Region III), received by BSC on May 9, 1990. The requirement to install monitoring wells MW-14 and -15, as proposed in the RFI Work Plan, was deleted by this letter and additional sampling rounds at Laurel Run were added.

#### **5.3.1 General Sampling Procedures**

Groundwater and surface water samples were collected during three sampling rounds conducted during the last week of April, June, and September 1990. Sampling for RFI parameters in April and June (Rounds 1 and 2) was conducted by Dames & Moore simultaneous with groundwater sampling by Baker/TSA for PADER monitoring requirements.



Before purging of each well, the depth to ground water from the top of the outer steel casing was measured using an electronic water level indicator. The depth to water was recorded to the nearest 0.01 foot. The volume of water necessary to purge three well volumes was calculated. At least three well volumes were purged from each well, with the exceptions discussed in Sections 5.4.1 and 5.4.2. Wells were sampled following the procedures described in Sections 5.4.1 and 5.4.2.

New latex gloves were worn at each sampling location. All collected samples were placed in clean sample containers, preserved as required, sealed, labeled, and placed in a cooler maintained at 4°C. A chain of custody form was filled out for each shipping container. The shipping coolers or shuttles were shipped via Federal Express to Wadsworth/Alert Laboratories of Canton, Ohio, within 24 hours of sample collection. All sampling equipment was decontaminated between sampling locations pursuant to the procedures described in Section 4.1.1 of this report.

Field blanks, trip blanks, and field duplicates were submitted to the laboratory to assess the quality of the field procedures, to detect possible outside sources of contamination during transit or at the laboratory, and to assess the precision of laboratory analyses.

#### 5.3.2 Sampling at SWMU 18 - HWM-1 Landfill

Wells MW-5, -6, -7, -8, -9, and -10, which are used to monitor groundwater quality at the HWM-1 Landfill, were purged of three well volumes during the first and second sampling rounds using a portable "Well Wizard" bladder pump and tubing owned by Baker/TSA. All wells are 2 inches in diameter. Groundwater samples were collected from wells MW-5 through MW-10 during the first two sampling rounds using a decontaminated Teflon bailer. Dedicated Well Wizard bladder pump systems with Teflon-lined tubing were installed in wells MW-5 through MW-10 before the September (third) sampling round. The dedicated Well Wizards were then used to purge and sample the wells during the third sampling round. The Well Wizard bladder pump's normal flow rate is 0.50 gallon per minute, which was adjusted downward to a slow stream for filling vials intended for volatile organic analysis.

Samples to be analyzed for dissolved metals were pumped from a clean plastic bottle through a disposable 0.45-micron filter directly into the sample bottles containing the proper preservatives. A peristaltic pump with new tygon tubing for each sample was used in the filtering process.

#### 5.3.3 Sampling at SWMU 30 - Residual Waste Landfill

Wells MW-2, -3, and -4, which are used to monitor groundwater quality at the Residual Waste Landfill, and well MW-1 (a background well) were purged with dedicated submersible pumps. All four wells are 6 inches in diameter. The submersible pump in well MW-3 was inoperative during the third sampling round, so a decontaminated bladder pump was used to purge three well volumes. During all sampling rounds, purging of wells MW-2 and -4 was intermittent because the wells were pumped dry and had to be allowed to recharge before purging could continue and three well volumes could be excavated. Only 1.5 well volumes could be purged before total evacuation. Because recharge of well MW-1 was very slow during all sampling rounds, it was allowed to recharge overnight and was sampled the next day.

Groundwater samples were collected using the dedicated submersible pump, piping, and hose for each well. Groundwater samples, except those to be analyzed for dissolved metals, were collected through dedicated hose and placed directly into the sampling bottles containing the proper preservative(s). All sample bottles were labeled with the required information.

Samples to be analyzed for dissolved metals were pumped from a clean plastic bottle through a disposable 0.45-micron filter directly into the sample bottles containing the proper preservative(s). A peristaltic pump with new tygon tubing for each sample was used in the filtering process.

#### 5.3.4 Laurel Run Sampling

Surface water and sediments were collected in succession from downstream to upstream locations as shown on Figure 15 (L6 to L1). One sediment sample was collected at each monitoring location concurrent with Round 1 sampling. A stainless steel trowel was used to collect surface sediment from the base of the stream and to place the sediment directly into the sample bottles. A stainless steel trowel decontaminated in accordance with the procedures described in Section 4.1.1 was used at each sampling location. Surface water samples to be analyzed for total metals were collected using plastic water sample containers filled directly in the stream by immersing them completely under water, where stream depth permitted. Water samples for dissolved metals analyses were collected in unused clean plastic bottles and then filtered into a clean plastic bottle using 0.45-micron disposable filters, dedicated tubing, and a peristaltic pump.

### 5.4 SAMPLING RESULTS AND DISCUSSION

#### 5.4.1 SWMU 18 - HWM-1 Landfill Results

The analytical results of three rounds of groundwater sampling in monitoring wells MW-5 through MW-10 are shown in Table 5-4. Groundwater samples were analyzed for total and dissolved cadmium, chromium, lead, and zinc. Monitoring wells 5, 6, 7, 9, and 10 lie downgradient and along the perimeter of the HWM-1 Landfill. MW-8 is located immediately upgradient of the HWM-1 Landfill. However, MW-8 water samples may not accurately represent upgradient water quality conditions because the well is in such close proximity to the HWM-1 Landfill that it may be impacted by local groundwater flow through fractures in the limestone aquifer beneath HWM-1.

To assess whether further investigation of HWM-1 is needed, the concentrations of total metals in unfiltered water samples and dissolved metals in filtered water samples were compared to their respective values listed in the USEPA's National Primary and Secondary Drinking Water Standards (NPDWSs and NSDWSs), included as Table 5-5. No further investigation will be required, as specified in the RFI Work Plan, if the metal concentrations are below the NPDWSs.

##### 5.4.1.1 SWMU 18 - Round 1 Results

Round 1 analytical results for filtered and unfiltered groundwater samples collected from wells 5 through 10 on March 28 and 29, 1990, are shown in Table 5-4.

##### 5.4.1.1.1 Dissolved Metals Not Detected

Dissolved cadmium, chromium, and lead were not detected in filtered groundwater samples.

##### 5.4.1.1.2 Dissolved Metal Detected Below Standard

The concentrations of dissolved zinc ranged from 20 to 80 ug/l, less than the NSDWS for zinc of 5,000 ug/l. No dissolved metals were detected at concentrations greater than the NPDWSs or NSDWSs.

##### 5.4.1.1.3 Total Metals Not Detected

Total cadmium was not detected in unfiltered groundwater samples from wells MW-5 through MW-10.

**Table 5-4**  
**ANALYTICAL RESULTS FOR MONITORING WELLS AT HWM-1 LANDFILL (SWMU 18)**

MONITORING WELL	MW-5		MW-5		MW-5		MW-6		MW-6		MW-6		MW-7		MW-7		MW-7	
SAMPLING DATE	3/90		6/90		9/90		3/90		6/90		9/90		3/90		6/90		9/90	
Metals (ug/l)	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI
Cadmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	-	-	30	-	-	-	70	-	-	-	20	-	30	-	-	-	-	-
Lead	-	-	50 J	-	-	-	210	-	20 U	-	-	-	60	-	120 J	20	-	-
Zinc	110	20 U	200 U	50 U	30 U	30 U	620	20 U	100 U	40 U	50 U	30 U	230	60	330 J	210	40 U	20 U

MONITORING WELL	MW-8		MW-8		MW-8 DUPL.		MW-8		MW-9		MW-9		MW-9		MW-9 DUPL.	
SAMPLING DATE	3/90		6/90		6/90		9/90		3/90		6/90		9/90		9/90	
Metals (ug/l)	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI
Cadmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	20	-	-	-	-	-	-	-	30	-	-	-	-	-	-	-
Lead	190	-	20 J	-	3 J	-	-	-	120	-	30 J	50	-	-	-	-
Zinc	410	60	260 U	70 U	20 U	6 U	30 U	30 U	250	60	100 U	660 U	70 U	30 U	7 U	7 U

MONITORING WELL	MW-10		MW-10		MW-10	
SAMPLING DATE	3/90		6/90		9/90	
Metals (ug/l)	TOT <sup>a</sup>		DI <sup>a</sup>		TOT	
Cadmium	-		-		-	
Chromium	-		-		-	
Lead	40		-		-	
Zinc	290		80		-	

#### 5.4.1.1.4 Total Metals Detected Below Standards

Total chromium was detected in MW-7, MW-8, and MW-9 at concentrations ranging from 20 to 30 ug/l, which are less than the NPDWS. Total lead was detected in MW-5 and MW-10 at concentrations ranging from 40 to 50 ug/l, which do not exceed the NPDWS. Total zinc was detected at concentrations ranging from 110 to 620 ug/l, which are less than the NSDWS.

#### 5.4.1.1.5 Total Metals Detected Above Standards

Total chromium was detected in ground water from MW-6 at 70 ug/l, which is greater than the NPDWS of 50 ug/l. Total lead concentrations in water samples from MW-6, -7, -8, and -9 (210, 60, 190, and 120 ug/l, respectively) were greater than the NPDWS for lead of 50 ug/l.

**Table 5-5  
DRINKING WATER STANDARDS**

**NATIONAL PRIMARY DRINKING WATER STANDARDS**

Constituent	MCL <sup>1</sup> mg/L	Constituent	MCL <sup>1</sup> mg/L
<b>INORGANICS</b>			
Arsenic (As) .....	0.05	Lindane .....	0.004
Barium (Ba) .....	1.0	Methoxychlor .....	0.1
Cadmium (Cd) .....	0.01	Toxaphene .....	0.005
Chromium (Cr) .....	0.05	Total trihalomethanes .....	0.10
Fluoride (F) .....	4.0	<b>RADIONUCLIDES</b>	
Lead (Pb) .....	0.05	Beta particles and photon activity, mrem .....	4 (annual dose equivalent)
Mercury (Hg) .....	0.002	Gross alpha, pCi/L .....	15
Nitrate (as N) .....	10.0	Radium-226 and 228, pCi/L .....	5
Selenium (Se) .....	0.01	<b>VOLATILE ORGANIC CHEMICALS</b>	
Silver (Ag) .....	0.05	Benzene .....	0.005
<b>MICROBIOLOGICALS</b>		Carbon tetrachloride .....	0.005
Coliforms .....	1/100 mL	1,2-Dichloroethane .....	0.005
<b>PHYSICAL CHARACTERISTICS</b>		1,1-Dichloroethylene .....	0.007
Turbidity, NTU .....	1-5	1,1,1-Trichloroethane .....	0.20
<b>ORGANICS</b>		para-Dichlorobenzene .....	0.075
2,4-D .....	0.1	Trichloroethylene .....	0.005
2,4,5-TP Silver .....	0.01	Vinyl chloride .....	0.002
Endrin .....	0.0002		

**NATIONAL SECONDARY DRINKING WATER STANDARDS**

Constituent	SMCL <sup>2</sup> Level (mg/L)	Constituent	SMCL <sup>2</sup> Level mg/L
Chloride (Cl) .....	250	Manganese (Mn) .....	0.05
Color, color units .....	15	Odor, threshold odor number .....	3
Copper (Cu) .....	1	pH, pH units .....	6.5-8.5
Corrosivity .....	Noncorrosive	Sulfate (SO <sub>4</sub> ) .....	250
Fluoride .....	2.0	Total dissolved solids (TDS) .....	500
Surfactants (MBAS) .....	0.5	Zinc (Zn) .....	5.0
Iron (Fe) .....	0.3		

Reference: The Water Encyclopedia, 1990

Notes:

(1) MCL: Maximum permissible contaminant level in water which is delivered to any user of a public water system

(2) SMCL: Secondary Maximum Contaminant Level

**5.4.1.2 SWMU 18 - Round 2 Results**

Round 2 analytical results for filtered and unfiltered groundwater samples collected from wells 5 through 10 between June 25 and 28, 1990, are shown in Table 5-4.

**5.4.1.2.1 Dissolved Metals Not Detected**

Dissolved cadmium and chromium were not detected in groundwater samples.

**5.4.1.2.2 Dissolved Metals Detected Below Standard**

Dissolved lead was detected in MW-7 at 20 ug/l and in MW-9 at 50 ug/l (equal to the NPDWS). The concentrations of dissolved zinc ranged from not detected to 660 ug/l/. No dissolved metals were detected at

Table 5-5 (Cont.)

PROPOSED MCLs		TENTATIVE MCLs	
Constituent	PMCL <sup>1</sup> ug/L	Constituent	TMCL <sup>1</sup> ug/L
Styrene .....	5.0	Dichloromethane .....	5.0
Toluene .....	2,000.00		
Xylene, total .....	10,000.00		
Nitrate .....	10,000.00		

concentrations greater than the NPDWSs or NSDWSs.

#### 5.4.1.2.3 Total Metals Not Detected

Total cadmium was not detected in groundwater samples from wells MW-5 through MW-10.

#### 5.4.1.2.4 Total Metals Detected Below Standards

Total chromium was detected at 30 ug/l in ground water from MW-5, which is less than the NPDWS. Total lead was detected in MW-5, MW-6, MW-8, and MW-9 at concentrations ranging from 20 to 50 ug/l, which do not exceed the NPDWS of 50 ug/l. Total zinc was detected at concentrations ranging from 100 to 330 ug/l, which are less than the NSDWS.

#### 5.4.1.2.5 Total Metals Detected Above Standards

For the second sampling round, only total lead (120 ug/l in MW-7) exceeded the NPDWS.

#### 5.4.1.3 SWMU 18 - Round 3 Results

Round 3 analytical results for filtered and unfiltered groundwater samples collected from wells 5 through 10 between September 27 and October 3, 1990, are shown in Table 5-4.

#### 5.4.1.3.1 Dissolved Metals Not Detected

Dissolved cadmium, chromium, and lead were not detected in groundwater samples.

#### 5.4.1.3.2 Dissolved Metals Detected Below Standard

The concentrations of dissolved zinc ranged from 20 to 30 ug/l, less than the NPDWS. No dissolved metals were detected at concentrations greater than the NPDWSs or NSDWSs.

#### 5.4.1.3.3 Total Metals Not Detected

Total cadmium and lead were not detected in groundwater samples from wells MW-5 through MW-10.

#### 5.4.1.3.4 Total Metals Detected Below Standards

Total chromium was only detected in ground water from MW-6, at a concentration of 20 ug/l. Total zinc was detected at concentrations ranging from 30 to 70 ug/l. Total zinc and chromium were not detected at concentrations greater than the NPDWS or NSDWS.

#### 5.4.1.3.5 Total Metals Detected Above Standards

For the third sampling round, no metals were detected at concentrations greater than the NPDWSs or NSDWSs.

#### 5.4.2 SWMU 18 - Discussion of Results

The detected concentration of dissolved metals in three rounds of filtered groundwater samples from wells MW-5 through MW-10 did not exceed the NPDWSs and NSDWSs. The only dissolved metals detected were dissolved lead in water samples from MW-7 (20 ug/l) and MW-9 (50 ug/l), and dissolved zinc in all samples. Ground water flows from MW-7 toward Laurel Run. Ground water flows from MW-9 toward the quarry. In a separate study conducted at the request of the PADER to better define groundwater flow and quality in the vicinity of the HWM-1 Landfill, multilevel piezometers 14S, M, D and 15S, M, D were installed adjacent to Laurel Run, and wells MW-16, -17, and -18 (Figure 15) were installed along the southern edge of the quarry. The wells were sampled on September 19, 1990. No dissolved lead was detected at MW-14S, M, D, MW-15M, D and MW-16, -17, or -18 (REWAI, 1991). The only location where dissolved lead was detected was at MW-15S. Dissolved lead was detected at 0.007 mg/l, an order of magnitude below the NPDWS.

By the third sampling round in September 1990, the concentrations of total metals in unfiltered water samples from MW-5 through MW-10 were below the NPDWS and NSDWS. Also at this time, 9 months after completion of the cap at the HWM-1 Landfill, no total or dissolved cadmium or lead was detected, and total chromium was detected at 20 ug/l only in MW-6.

Metals were detected more frequently and at higher concentrations in unfiltered water samples than in their filtered counterparts. Filtering of the water through the 0.45-micron filter removes fine particles that contain or have adsorbed metals. Sediment particles within the unfiltered water samples may release metals to solution during the analytical sample preparation process and thereby bias the results toward greater concentrations.

The RFI Work Plan states that total metal concentrations less than the NPDWSs will be acceptable for risk analysis. However, conversations with Kathleen Shelton, Toxicologist/Project Manager of the USEPA, during a site visit at the Steelton plant on December 13, 1990, indicated that USEPA Region III considers dissolved metal concentrations to be more appropriate for risk analysis. In addition, unfiltered samples may contain sediment particles that are not normally transported in the ground water (Puls and Barcelona, 1989). Comparison of the dissolved metal data to the NPDWSs may be more appropriate than comparing total metal values because the MCLs are defined for contaminants in water that are delivered to any user of a public water system, typically after the water has been filtered.

Because dissolved metal concentrations and third round total metal concentrations in water samples are below the NPDWSs and NSDWSs, no further investigation of SWMU 18 is required under the RFI Work Plan. The cap installed over the HWM-1 Landfill in December 1989 appears to have had an effect on infiltration of rainwater and transport of EAF metals to the ground water. Quarterly sampling of wells MW-5, -6, -8, and -10 for dissolved metals is being conducted for the PADER and will continue for a minimum of 30 years.

#### 5.4.3 SWMU 30 - Residual Waste Landfill Results

The analytical results for three rounds of groundwater samples from monitoring wells MW-1, -2, -3, and -4 are shown in Table 5-6. Groundwater samples were analyzed for the primary drinking water constituents consisting of volatile organic compounds (VOCs), chlorinated pesticides, herbicides, total drinking water metals (8), fluoride, and nitrates. MW-2, -3, and -4 lie south and southwest of the Residual Waste Landfill. MW-1 is a background well that is separated from the landfill by the Hempt Brothers Quarry, as shown on Figure 14.

To assess whether further investigation of the Residual Waste Landfill is needed, the analytical data were compared to values listed in the NPDWSs and NSDWSs. Those parameters without values in the NPDWSs or NSDWSs were compared to their proposed or tentative MCL concentrations. Dichlorodifluoromethane, for which there is no NPDWS, NSDWS, or MCL, was compared to its lifetime health advisory concentration. The above standards are summarized in Table 5-5. No further investigation will be required if the total metal concentrations are less than the NPDWSs, as specified in the RFI Work Plan, and if the other parameters are detected at concentrations less than their applicable standards.

#### 5.4.3.1 SWMU 30 - Round 1 Results

Round 1 analytical results for groundwater samples collected from wells 1 through 4 on March 28 and 29, 1990, are shown in Table 5-6.

##### 5.4.3.1.1 Volatile Organics

Volatile organic compounds (VOCs), if detected, were measured at concentrations approaching the analytical detection limit. For Round 1 samples, no VOCs detected in wells 1 through 4 were above applicable NPDWSs or MCLs. The VOC 1,2-dichloroethane was detected at 2 ug/l in a water sample from MW-4, less than the NPDWS of 5 ug/l. Styrene was detected at 0.5 ug/l in a water sample from MW-2, which is also less than the proposed MCL of 5 ug/l. Toluene was detected at 1.0 ug/l in water samples from MW-2 and MW-4, which are less than the proposed MCL of 2,000 ug/l. Total xylenes were detected at 0.5 ug/l in a water sample from MW-2, also less than the proposed MCL of 10,000 ug/l. Dichloromethane was detected at 3 ug/l in a water sample from MW-4, below the tentative MCL of 5 ug/l.

##### 5.4.3.1.2 Pesticides and Herbicides

Chlorinated pesticides and herbicides were not detected in water samples from wells MW-1 through MW-4.

##### 5.4.3.1.3 Total Metals Not Detected

Total chromium and selenium were not detected in the water samples from wells MW-1 through MW-4.

##### 5.4.3.1.4 Total Metals Below Standards

Total barium was detected at 29 ug/l in water samples from MW-1 and MW-3, less than the NPDWS of 50 ug/l. Total lead was detected in water samples from MW-1, -2, and -3 at concentrations ranging from 13 to 25 ug/l, which are less than the NPDWS.

##### 5.4.3.1.5 Total Metals Above Standards

Total cadmium was detected at 13 ug/l in a water sample from MW-4, greater than the NPDWS of 10 ug/l. Total lead was detected at 300 ug/l in a water sample from MW-4, greater than the NPDWS of 50 ug/l.

##### 5.4.3.1.6 Fluoride and Nitrate

The concentrations of fluoride and nitrate detected in water samples from monitoring wells MW-1 through MW-4 were below the NSDWSs of 20 mg/l and 10.0 mg/l, respectively.

#### 5.4.3.2 SWMU 30 - Round 2 Results

Round 2 analytical results for groundwater samples collected from wells MW-1 through MW-4 on June 25 through June 28, 1990, are shown in Table 5-6.

**Table 5-6**  
**ANALYTICAL RESULTS FOR MONITORING WELLS AT RESIDUAL LANDFILL (SWMU 30)**

MONITORING WELL	MW-1	MW-1	MW-1	MW-2	MW-2	MW-2	MW-3	MW-3	MW-3 DUPL.	MW-3	MW-3 DUPL.
SAMPLING DATE	3/90	6/90	9/90	3/90	6/90	9/90	3/90	6/90	6/90	9/90	9/90
PARAMETER											
VOLATILE ORGANICS (ug/l)											
Benzene	-	-	.8	-	-	-	-	-	-	-	-
Styrene	-	-	-	0.5	-	-	-	-	-	-	-
Toluene	-	-	-	1	-	-	-	-	-	-	-
Total Xylenes	-	-	-	0.5	-	-	-	-	-	-	-
1,2-Dichloroethane	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	-	-	5 U	-	.7 J	-	-	-	-	-	-
Dichlorodifluoromethane	-	-	-	-	1	-	-	-	-	-	-
CHLORINATED PESTICIDES	-	-	-	-	-	-	-	-	-	-	-
HERBICIDES	-	-	-	-	-	-	-	-	-	-	-
TOTAL METALS (ug/l)											
Barium	29	27 J	32	-	12 J	12	29	29	42 J	12	12
Lead	25	10	10	21	18	11	13	14	20	-	-
Cadmium	-	1	UL	-	-	UL	-	-	-	UL	UL
Chromium	-	-	-	-	-	-	-	18	24	-	-
Selenium	-	-	-	-	-	-	-	-	-	5.3	-
FLUORIDE (mg/l)	0.19 U	0.12	0.12	0.32 J	0.24	0.239	0.15 U	0.13	0.13	0.099	0.093
NITRATE (mg/l)	0.1 U	0.5	-	1.3	1.1	1.3	2.1	2.4	2.4	1.7	1.7

MONITORING WELL	MW-4	MW-4 DUPLICATE	MW-4	MW-4
SAMPLING DATE	3/90	3/90	6/90	9/90
PARAMETER				
VOLATILE ORGANICS (ug/l)				
Toluene	1	1	-	-
Total Xylenes	-	-	1	-
1,2-Dichloroethane	2 J	3 J	0.5 J	2
Dichloromethane	3 J	3 J	1 J	2 B
Dichlorodifluoromethane	-	-	2	-
CHLORINATED PESTICIDES	-	-	-	-
HERBICIDES	-	-	-	-
TOTAL METALS (ug/l)				
Lead	300	340	57	67
Cadmium	13 J	17 J	5	1.7
FLUORIDE (mg/l)	0.13 U	.18 U	.11	.126
NITRATE (mg/l)	-	-	-	-

Note: Only those compounds detected are listed.



#### 5.4.3.2.1 Volatile Organics

VOCs, if detected, were at concentrations approaching the analytical detection limit. For Round 2 samples, no VOCs were detected in wells MW-1 through MW-4 at concentrations above the respective NPDWS, proposed MCL, tentative MCL, or lifetime health advisory. The VOC 1,2-dichloroethane was detected at 0.5 ug/l in the water sample from MW-4, less than the NPDWS of 5 ug/l. Total xylenes were detected at 1 ug/l in a water sample from MW-4, less than the proposed MCL of 10,000 ug/l. Dichloromethane was detected at 0.7 ug/l in the water sample from MW-2 and at 1 ug/l in the water sample from MW-4, less than the tentative MCL of 5 ug/l. Dichlorodifluoromethane was detected at 1 ug/l in the water sample from MW-2 and at 2 ug/l in the water sample from MW-4, less than the lifetime health advisory concentration of 1,000 ug/l. No proposed or tentative MCL existed for dichlorodifluoromethane at the time of this report.

#### 5.4.3.2.2 Pesticides and Herbicides

Chlorinated pesticides and herbicides were not detected in water samples from wells MW-1 through MW-4.

#### 5.4.3.2.3 Total Metal Not Detected

Total selenium was not detected in water samples from wells MW-1 through MW-4.

#### 5.4.3.2.4 Total Metals Below Standards

Total chromium was detected in MW-3 at 18 ug/l, less than the NPDWS. Total cadmium was detected at 1 ug/l in MW-1 and at 5 ug/l in MW-4, less than the NPDWS. Total barium was detected at concentrations ranging from 12 to 42 ug/l in MW-1 through MW-3, which are less than the NPDWS. Total lead was detected at concentrations ranging from 10 to 18 ug/l in samples from MW-1 through MW-3, which are less than the NPDWS.

#### 5.4.3.2.5 Total Metal Above Standards

Total lead was detected at 57 ug/l in a water sample from MW-4, greater than the NPDWS of 50 ug/l.

#### 5.4.3.2.6 Fluoride and Nitrate

The concentrations of fluoride and nitrate detected in water samples from monitoring wells MW-1 through MW-4 were below the NSDWSs of 20 mg/l and 10.0 mg/l, respectively.

#### 5.4.3.3 SWMU 30 - Round 3 Results

Round 3 analytical results for groundwater samples collected from wells MW-1 through MW-4 between September 27 and October 3, 1990, are shown in Table 5-6.

##### 5.4.3.3.1 Volatile Organics

All VOCs detected in Round 3 water samples measured at concentrations not greater than the respective NPDWSs or MCLs. Benzene was detected at 0.8 ug/l in the water sample from background well MW-1, less than the NPDWS of 1 ug/l. The compound 1,2-dichloroethane was detected at 2 ug/l in the water sample from MW-4, below the NPDWS of 5 ug/l. Dichloromethane was detected at 5 ug/l in the water sample from background MW-1 and at 2 ug/l in the water sample from MW-4 (tentative MCL is 5 ug/l).

##### 5.4.3.3.2 Pesticides and Herbicides

Chlorinated pesticides and herbicides were not detected in water samples from wells MW-1 through MW-4.

##### 5.4.3.3.3 Total Metals Not Detected

Total chromium was not detected in water samples from wells MW-1 through MW-4.

#### 5.4.3.3.4 Total Metals Detected Below Standards

Total cadmium was detected only in MW-4 at 1.7 ug/l, below the NPDWS. Total barium was detected at concentrations ranging from 12 to 32 ug/l in water samples from MW-1 through MW-3, less than the NPDWS. Total lead was detected at 10 ug/l in MW-1 and 11 ug/l in MW-2, which are less than the NPDWS.

#### 5.4.3.3.5 Total Metals Detected Above Standards

Total selenium was detected at 5.3 ug/l in the unfiltered water sample from MW-3, greater than the NPDWS of 5 ug/l, but was undetected in the duplicate sample. Total lead was detected at 67 ug/l in a sample from MW-4, greater than the NPDWS.

#### 5.4.3.3.6 Fluoride and Nitrate

The concentrations of fluoride and nitrate detected in water samples from monitoring wells MW-1 through MW-4 were less than the NSDWSs.

#### 5.4.4 SWMU 30 - Discussion of Results

The concentrations of VOCs, pesticides and herbicides, total drinking water metals, fluoride, and nitrate in groundwater samples from MW-1 through MW-4 did not exceed the NPDWSs or other applicable standards, with the exception of selected total metal concentrations in water samples from MW-4.

The concentrations of total lead and total cadmium in several unfiltered water samples from MW-4 were above the NPDWS (Table 5-7). In round 1, 2, and 3 water samples from MW-4, total lead was detected at 300 ug/l, 57 ug/l, and 67 ug/l, respectively. These concentrations are greater than the NPDWS of 50 ug/l. Total cadmium was detected at 13 ug/l in a water sample from MW-4 during Round 1, greater than the NPDWS of 10 ug/l. Total cadmium concentrations in the following Round 2 and 3 water samples from MW-4 were below the NPDWS.

The total metal concentrations for MW-4 probably do not represent groundwater quality at that location because fine clay particles from the aquifer formation are biasing (elevating) the total metal results. Water samples collected from MW-4 during all three rounds were brown in color and cloudy in appearance. Even after three well volumes had been purged from the well, a large amount of suspended solids remained in the water. This condition probably occurred because MW-4 is an open hole from 52 to 150 feet in the interbedded fissile shales, siltstones, and sandstones of the Gettysburg Formation, and has no screen or sand pack to filter out formation particles. Comparison of the dissolved metal data to the NPDWSs is more appropriate than comparing total metal values, because the MCLs are defined for contaminants in water that is delivered to any user of a public water system, typically after the water has been filtered.

Although the concentrations of total lead and cadmium in unfiltered water samples from MW-4 exceeded the NPDWSs in several instances, analytical results for dissolved lead and chromium in filtered water samples collected simultaneously for PADER monitoring requirements did not exceed the NPDWSs, as shown in Table 5-7.

Because PCOCs in groundwater samples from MW-1, MW-2, MW-3, and MW-4 (with samples from MW-4 filtered for metal analyses) are below the NPDWSs, NSDWSs, and other applicable standards, no further investigation of SWMU 30 is required under the RFI Work Plan. Total metal results for MW-4 are biased toward greater concentrations because of the large amount of suspended solids in the water. Therefore, dissolved metal results for MW-4 are considered to be more representative of groundwater conditions and to be most appropriate for use in risk analysis. Quarterly sampling of MW-1, MW-2, and MW-3 for selected dissolved metals and other

**Table 5-7**  
**ANALYTICAL RESULTS FOR DISSOLVED LEAD AND**  
**CADMIUM FOR WATER SAMPLES FROM MONITORING WELL 4**

ANALYZED BY BAKER/TSA LABORATORIES IN SUPPORT OF PADER MONITORING			
MONITORING WELL	MW-4		
SAMPLING DATE	3/90 <sup>(1)</sup>	6/90 <sup>(1)</sup>	9/90 <sup>(2)</sup>
<u>DISSOLVED METALS<sup>(3)</sup></u>			
Lead	< .005	< .005	< .005
Cadmium	< .005	< .005	< .005

- (1) Samples collected by Baker/TSA simultaneously with Dames & Moore RFI sampling.
- (2) Samples collected by Dames & Moore.
- (3) Water samples filtered through 0.45-micron filter in the field prior to analysis.

groundwater parameters is being conducted for PADER. Monitoring of the ground water at MW-4 is performed quarterly for dissolved metals and other selected parameters.

#### 5.4.5 Laurel Run Results

##### 5.4.5.1 Surface Water Results

Analytical results for three rounds of surface water samples collected at six monitoring points along Laurel Run (LR-1 through LR-6) are shown in Table 5-8. Unfiltered and filtered water samples were analyzed for cadmium, chromium, lead, and zinc. The pH, conductivity, and temperature were recorded for the last two sampling rounds, as shown in Table 5-9.

To assess whether further investigation of Laurel Run is necessary, the analytical data were compared to the appropriate values listed in the NPDWSs and NSDWSs. The data were also compared to the aquatic life criteria listed in BSC's NPDES Permit No. 008303.

The concentrations of total and dissolved metals detected in three rounds of surface water samples at points LR-1 through LR-6 are less than the NPDWS and NSDWS. Cadmium and chromium were not detected in three rounds of filtered and unfiltered water samples from LR-1 through LR-6. Total lead was detected in only three water samples at concentrations ranging from 0.006 to 0.01 mg/l, approaching the analytical detection limit. Zinc was detected at concentrations ranging from 0.01 to 0.1 mg/l, less than the NSDWS of 5,000 mg/l.

##### 5.4.5.2 Sediment Results

Analytical results for one round of sediment samples collected at six monitoring points along the Laurel Run (LR-1 through LR-6) are shown in Table 5-10. All sediment samples consisted of dark-brown coarse-grained sand and gravel with some silt and clay. Sediment samples were analyzed for cadmium, chromium, lead, and zinc. The sample locations are shown on Figure 17. Sample locations 1 and 2 are upstream from the trace of the fault and are not discharge points for groundwater flow from the HWM-1 Landfill, as shown on Figure 17. Downstream

sample points 3, 4, 5, and 6 are downgradient of the HWM-1 Landfill and receive groundwater discharge from the HWM-1 Landfill.

**Table 5-8**  
**TOTAL AND DISSOLVED METAL CONCENTRATIONS**  
**IN SURFACE WATER SAMPLES FROM LAUREL RUN**

SAMPLING POINT	LR-1		LR-1		LR-1		LR-2		LR-2		LR-2		LR-3		LR-3		LR-3	
SAMPLING DATE	3/90		6/90		9/90		3/90		6/90		9/90		3/90		6/90		9/90	
METALS (mg/l)	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI
Cadmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	.006	-	-	-	-	-	.01	-	-	-
Zinc	.02 U	.01 U	.06 U	.06 U	.05	.05	.03 U	.02 U	.07 U	.06 U	.05	.03	.03 U	-	.04 U	.03 U	.04	.04

SAMPLING POINT	LR-4		LR-4		LR-4 DUPLICATE		LR-4		LR-4 DUPLICATE		LR-5		LR-5		LR-5	
SAMPLING DATE	3/90		6/90		6/90		9/90		9/90		3/90		6/90		9/90	
METALS (mg/l)	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI	TOT	DI
Cadmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	.008	-	-	-	-	-	-	-	.006	-	-	-
Zinc	.01 U	-	.05 U	.05 U	.04 U	.03 U	.04	.04	.05	.03	.03 U	.02 U	.05 U	.04 U	.02	.02

SAMPLING POINT	LR-6		LR-6 DUPLICATE		LR-6		LR-6	
SAMPLING DATE	3/90		3/90		6/90		9/90	
METALS (mg/l)	TOT	DI	TOT	DI	TOT	DI	TOT	DI
Cadmium	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-
Lead	-	-	-	-	.008	-	-	-
Zinc	.01 U	.01 U	.02 U	-	.05 U	.02 U	.1	.04

To assess the influence, if any, of groundwater discharge from the HWM-1 Landfill on the sediments of the Laurel Run, background metal concentrations for sediment from locations LR-1 and LR-2 were compared to metal concentrations in sediment at monitoring points LR-3 through LR-6, located downgradient of the landfill.

#### 5.4.5.2.1 Cadmium

Cadmium was undetected in sediment samples at all monitoring points.

#### 5.4.5.2.2 Chromium

The maximum concentration of chromium detected in background sediments (LR-2) was 19 mg/kg. Chromium concentrations in sediment from downgradient locations (LR-3 through LR-6) were less than the background value.

**Table 5-9**  
**pH, CONDUCTIVITY, AND TEMPERATURE FOR**  
**LAUREL RUN SURFACE WATER SAMPLES**

SAMPLING DATE	6/90			9/90		
MEASUREMENT	pH	Conductivity (umhos/cm)	Temperature (°C)	pH	Conductivity (umhos/cm)	Temperature (°F)
MONITORING POINT						
LR-1	8.17	437	73.2	7.99	393	65.8
LR-2	8.15	593	72.7	8.30	403	65.7
LR-3	7.95	534	71.1	8.00	451	65.3
LR-4	8.08	594	69.6	8.20	593	66.4
LR-5	8.04	680	69.9	8.17	588	67.3
LR-6	7.44	686	76.3	8.17	721	67.2

#### 5.4.5.2.3 Zinc

The maximum concentration of zinc detected in background sediments was 71 mg/kg (LR-1). Only the zinc concentration of 83 mg/kg in sediment at location LR-6 exceeded the background value.

#### 5.4.5.2.4 Lead

The maximum concentration of lead detected in background sediments was 20 mg/kg (LR-2). A lead concentration of 21 mg/kg at LR-4 and LR-5 is essentially equal to the background value. A lead concentration of 27 mg/kg at LR-3 and 35 mg/kg at LR-6 exceeded the background value.

#### 5.4.6 Laurel Run - Discussion of Results

Analysis of water level data from multilevel piezometers installed at the request of PADER (Section 5.2.3.3) support a conclusion that ground water discharges to Laurel Run from depth. Three rounds of surface water results

**Table 5-10**  
**METAL CONCENTRATIONS IN SEDIMENT SAMPLES FROM LAUREL RUN**  
**MARCH 28, 1990**

METALS (mg/kg)	DETECTION LIMIT (mg/kg)	LR-1	LR-2	LR-3	LR-4	LR-5	LR-6	LR-6 DUPLICATE
Cadmium	0.5	-	-	-	-	-	-	-
Chromium	1	14	19	10	15	14	15	11
Lead	2.5	18	20	27	21	21	35	36
Zinc	0.5	71	64	67	66	70	83	80

from the RFI indicate that over a 9-month period, electric arc furnace PCOCs (cadmium, chromium, lead, and zinc) potentially contained in ground water discharged from HWM-1 did not adversely affect surface water quality in Laurel Run. In addition, there were no significant differences in water quality between sampling locations upstream from areas of groundwater discharge from the landfill (LR-1 and LR-2) and those downstream (LR-3 through LR-6). There was no discernable difference in water quality between locations upstream of the trace of the fault between the Epler and Gettysburg formations and downstream locations. Therefore, no further investigation of Laurel Run surface water is necessary.

Concentrations of metals in sediment samples downstream from the HWM-1 Landfill were at or below background values except for lead in sediment from LR-3 and LR-6 and zinc in sediment from LR-6. However, these exceedances of background values in sediment do not appear to pose a risk to surface water quality because lead and zinc were not detected above the NPDWSs or NSDWSs in three rounds of surface water samples from all monitoring locations. Also, because ground water discharges into Laurel Run from depth, sediments in Laurel Run can not impact groundwater quality. Therefore, no further investigation of Laurel Run sediments is recommended.

## 6.0 CONCLUSIONS

### 6.1 GENERAL

For the SWMUs examined in the course of the RFI, the approved RFI Workplan identified three criteria that are to be used in determining whether further action will be required at any given SWMU. These criteria are:

1. No further action will be necessary at any given SWMU if the results of air quality investigations indicates that there have been no releases of volatile organic compounds at unsafe levels and;
2. No further action will be necessary if a given SWMU can be demonstrated to have provided a complete containment of PCOCs or;
3. Notwithstanding the above, no further action will be necessary at any given SWMU if the result of risk evaluation indicates that there is no unacceptable risk to human health or the environment posed by an identified release of PCOCs.

### 6.2 HISTORICAL INVESTIGATION

Based on data gathered in the course of the historical investigation five SWMUs (4, 13, 14, 15, and 16) meet the criteria specified in items 1 and 2 above. Thus, no further action is recommended at these units. Volatile organic compounds were not revealed in any of the locations surveyed during the air investigation.

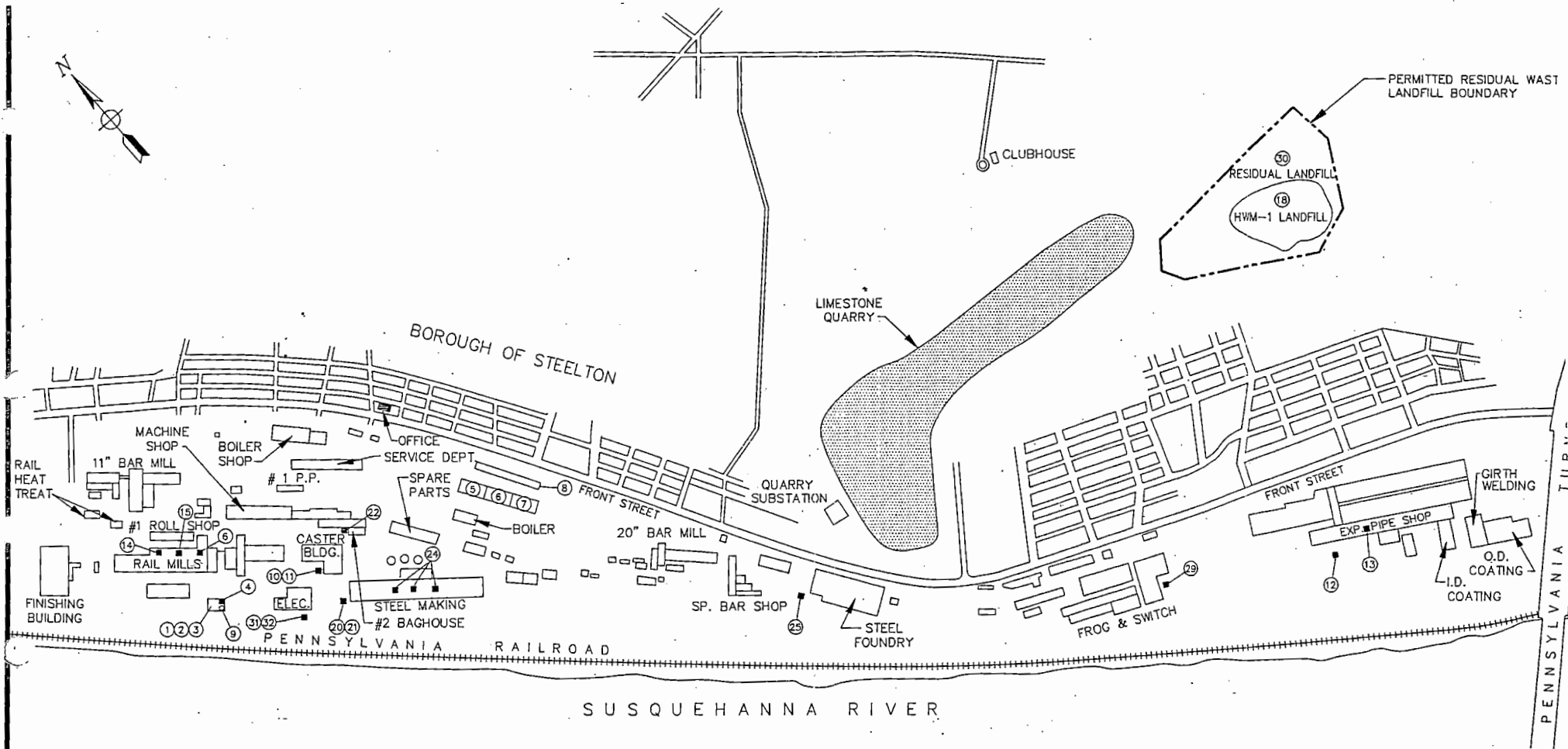
### 6.3 FIELD INVESTIGATION

Of the remaining 20 SWMUs involved in the Field Investigation, 19 units meet the criteria specified in item 3 above. Soil samples collected from SWMU 24, the EAF Spray Chamber Drop Legs, failed to meet the action level criteria developed by computer modeling (Volume 3). None of the SWMUs pose a threat to groundwater quality based on the Summers model (Volume 3). Indications of EAF dust transport via air were not observed.

It is recommended that additional investigations be performed at SWMU 24 to identify an appropriate mechanism for improving the current status of this unit such that calculated action levels can be met.

### 6.4 GROUNDWATER INVESTIGATION

The Groundwater Investigation revealed the presence of PCOCs in groundwater. The concentrations of PCOCs in the groundwater are observed to decrease over time. This is attributed to the closure and installation of a geo-synthetic cap at SWMU 18. Risk evaluation was conducted by comparison of PCOC concentrations in groundwater to NPDWS and NSDWS. Dissolved metals concentrations were employed for this purpose. By the third round of groundwater sampling, concentrations of PCOCs in the groundwater were uniformly below these standards. Concentrations of PCOCs identified in the Laurel Run do not pose a human health or environmental hazard. Monitoring is continuing at SWMUs 18 and 30 under the provisions of a PADER permit. No additional action is recommended.




0 500 1000 1500 FEET

GRAPHIC SCALE

EXPLANATION:

25 SWMU LOCATION

TITLE	SOLID WASTE MANAGEMENT UNIT LOCATIONS		
PROJECT	BETHLEHEM STEEL CORPORATION STEELTON, PENNSYLVANIA		
	 <b>Dames &amp; Moore</b> <small>WILLOW GROVE, PENNSYLVANIA</small>		
SCALE	AS SHOWN	DWN. BY	EMM
DATE	9-23-91	APPR. BY	P.E.R.
		JOB NO.	00120-090
		FIG. NO.	1

312668